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REVIEW of EDUCATIONAL RESEARCH

VOLUME IX

JUNE 1939

NUMBER 3

**PSYCHOLOGY OF LEARNING, GENERAL METHODS
OF TEACHING, AND SUPERVISION**

AMERICAN EDUCATIONAL RESEARCH ASSOCIATION
A Department of the
NATIONAL EDUCATION ASSOCIATION
1201 SIXTEENTH STREET NORTHWEST
WASHINGTON, D. C.

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Active members of the Association pay dues of \$5.00 per year. Of this amount \$4.00 is for subscription to the *Review*. The *Review* is published in February, April, June, October, and December.

Entered as second-class matter April 10, 1931, at the post office at Washington, D. C., under the Act of August 24, 1912.

REVIEW OF EDUCATIONAL RESEARCH

*Official Publication of the American Educational Research Association,
a department of the National Education Association*

The contents of the REVIEW are listed in the EDUCATION INDEX.

Volume IX**June 1939****Number 3**

PSYCHOLOGY OF LEARNING, GENERAL METHODS OF TEACHING, AND SUPERVISION

Reviews the literature from January 1936 to January 1939. Literature of earlier periods was reviewed in Vol. VI, No. 3, June 1936, and in Vol. III, No. 4, October 1933. For issues treating related subjects see inside back cover.

Prepared by the Committee:

William A. Brownell, *Chairman*; Angela M. Broening, Guy T. Buswell, Manley E. Irwin, and William Clark Trow.

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FOREWORD

THIS ISSUE is the third one to appear under this title. Beginning with the next cycle (1940) some reorganization of topics will occur, and the present issue is scheduled to appear under the title, "General Aspects of Instruction: Learning, Teaching, and the Curriculum," in June 1942. Learning theory and general methods of teaching will be included as at present, with perhaps some broadening and with the addition of *general* material on the curriculum. Supervision will be removed to the number on "Teacher Personnel"; and those phases of psychology, methods of teaching, and the curriculum which are particularly related to individual subject fields will be treated in a series of new numbers which will deal with the various subject fields. In the future, therefore, the unique values of the present material will be preserved and will be supplemented by integrated treatments of individual subject fields appearing in other issues of the *Review*.

In addition to dealing with methods of teaching and of supervision, the present issue includes research in those parts of psychology which are of most significance to educators. It brings to our attention the contributions which scientific discipline in a related field has to offer. A large part of progress in understanding complex phenomena should be looked for through the conjuncture of scientific endeavors in separate but related fields of study.

DOUGLAS E. SCATES,
Chairman of the Editorial Board.

CHAPTER I

Theoretical Aspects of Learning and Transfer of Training¹

WILLIAM A. BROWNELL

AS COMPARED with the corresponding chapters in earlier reviews this chapter gives more prominence, in the first section, to psychological as contrasted with more strictly educational research on learning, and to critical discussions as contrasted with purely experimental investigations. The second section, on transfer, omits the literature on retroactive inhibition (treated in Chapter II), and omits studies of character education because of the difficulty in isolating aspects which bear upon transfer.

Theoretical Aspects of Learning

Definitions of Learning

A generally acceptable definition of learning is by no means easily arrived at. Several attempts were made during the last three years. Cason (17) ascribed the present multiplicity of definitions to the existence of various "schools" of psychology, each with its own restricted types of experimental subjects and equally restricted attention to particular forms of learning. Cason suggested: "Learning is the establishment or strengthening of neural connections between stimulating processes and responding processes as a result of accompanying or immediately preceding activities" (17: 55). Ten objections to this definition were listed by Britt (6), who claimed that it reifies terms, makes superfluous neurological assumptions, and substitutes a cause-effect explanation when we must be content with descriptive accounts in terms of changed behavior. Britt defined learning as "the acquisition by a living organism of a mode of response which is adapted to a motivating problematical situation" (6: 467). Kellogg (77), agreeing in general with Britt's criticisms, noted that reliance upon neurological criteria removes evidence of learning to internal and hence unobservable events. Kellogg's definition was: "In a single word, learning is modification. In three words, it is modification of response. In a few more words, it is a persisting change or modification of behavior which results from repeated or continuous stimulation" (77: 100). In replies to Britt and to Kellogg, Cason (18, 19) charged the former with guilt of reification in his definition, and both with failure to recognize the necessarily dualistic character (instead of the behavioral character alone) of all psychological definitions, as well as the essential difference between the process of learning and its manifestations or indicators.

¹ Bibliography for this chapter begins on page 312.

Three attempts were made to define learning in mathematical terms. One by Hilgard (64) is treated in a later paragraph. Gulliksen and Wolfe (54, 55) dealt with a special case of learning, namely, discrimination. According to the formulas derived, accuracy in discrimination learning is inversely proportional to the difference, as determined psycho-physically, between the two stimuli. Predictions were shown to yield results in agreement with experimental findings, so far as these were available. Washburne (140) defined learning as "an increase, through experience, in problem-solving ability, . . . [or in the] ability to gain goals in spite of obstacles." His definition is represented in his formula:

$$e(h + m) = g(o + r)$$

in which e is effort expended, h is helps toward goal attainments (cues, implements, etc.), m is the memories and aids of imaginal experience, g is the goal, o is the external obstacles to be surmounted, and r is the resistance within the organism itself. In a later article Washburne (141) applied his "learning ratio" to experimentation on conditioning and on the whole-part problem of learning, stating that for such applications precise numerical equivalents for the elements of the formula are not needed.

Learning Theory or Learning Theories?

Whether or not all learning can be explained in terms of a single theory engaged the attention of a number of psychologists. Rexroad (112) initially differentiated seven types of learning: substitute S, substitute R, negative adaptation, serial habits acquired from serial stimulation, serial habits acquired in trial-and-error learning, flexible goal-seeking behavior, and coordination. The first four types have been more or less generally subsumed under conditioning; the last three, observed in trial-and-error learning, were thought also to be explicable as conditioning, since trial-and-error learning consists in the simultaneous or nearly simultaneous establishment of a number of conditioned responses. Kellogg (76) compared four types of learning (trial-and-error, Gestalt insight, conditioning, and sign learning); while relationships between the four types admitted of their logical reduction to a single type (conditioning), Kellogg saw little advantage in so doing. He held that all types of learning can be identified in complex learning and that there is value in thinking of them as separate.

Tolman (133), like Rexroad, distinguished between seven types of learning: substitute stimulus, signal, trial-and-error, a combination of signal and trial-and-error, delayed reaction, inferential, and inventive. All seven types, however, were regarded as explicable by his "sign-Gestalt-expectation hypothesis," though admittedly "different or modified structural laws may be necessary to account for learning or to direct learning of the different types." Guthrie (57) accepted the seven types of Tolman, but felt it possible to explain them all more directly and easily as conditioning.

Thorndike's theory of learning was subjected to three criticisms. That by Pax (96) was philosophical in character and was concerned largely with the assumptions underlying connectionism. He regarded the chief weakness of the S-R bond theory as an explanation of the learning process as lying in its lack of a principle of unity. The criticism by Tolman (134) contained his previously stated objections to viewing learning as the mere building of S-R complexes, and new objections to certain phases of Thorndike's more recent experimental work. The criticism offered by Judd and others (75) is treated later in this chapter.

Hull (72) developed his goal-gradient hypothesis into a "miniature scientific system," the center of which was his theory of learning. His formulation was arrived at deductively by means of eighteen definitions, six postulates, and thirteen theorems. Among other things Hull undertook to reconcile Thorndike's connectionism and Pavlov's conditioned reflex with his own conceptions and offered a variety of hypotheses susceptible to experimental verification. Buel (12) reported twelve objections to the Hull system based on learning experiments with rats.

Laws of Learning

Law of Exercise: use—It seems now to be rather generally conceded that use of a "connection" or reaction pattern per se has slight influence in a learning situation; instead, there must be some effect of the operation of the pattern. Thus, this "law" which at one time threatened to become the law of learning has lost considerably in prestige.

Law of Disuse—The effect of nonuse of a reaction pattern, as for example in the inhibition of a conditioned response, was explained by Wendt (146) as the result of competing reaction systems, and hence was not thought to be an independent process as suggested by Pavlov. Wenger (147) accepted Wendt's explanation as covering one type of inhibition, but not the type which is better accounted for in terms of proprioceptive facilitation. Pratt (103) likewise regarded interaction and interference as but partial explanations and held that for at least some of the phenomena attending nonuse the hypothesis of disintegration is required.

Law of Effect: general status—The Law of Effect, of all the so-called laws of learning, raised by far the most and the liveliest discussion and led to the largest amount of experimentation. Six psychologists participated in a symposium on this law. In starting the symposium Carr (16) was content largely to pose questions, for example, whether as formulated by Thorndike the law was not intended as purely descriptive of the facts of experience; and whether so far as explanation is concerned there may not be many valid laws of effect. Tolman (136) agreed that the Law of Effect can be made to fit the facts of experience and unsophisticated observation, but insisted that the law must be stated so as to give fuller recognition to "expectation sets" and hypotheses.

Thorndike (132) preferred a single law to a variety of laws and offered

two "fundamental principles" of learning, the second of which was supposed to cover all positive effects (rewards): "A modifiable connection becomes much stronger if it or its accompaniments or after-effects evokes the confirming reaction" (132: 205). He also cited experimental data to show (a) that the influence of a reward spreads or scatters to preceding and to succeeding connections, even to those two and three steps removed, and (b) that rewards are not cumulative—their effects, once a maximum has been reached, do not increase.

Two types of behavior must be distinguished, according to Culler (30), in any discussion of the influence of reward and punishment. Effect has nothing to do with one type, namely, conditioning, but it has much to do with learning. This is a position having much in common with that taken earlier by Scholberg (117). Backward effects, which have sometimes been denied as impossible, were said to be not only possible but also inevitable. Dashiell (33) also accepted the Law of Effect as in agreement with empirical data and pointed out that criticism of Thorndike's original statement had been based upon (a) difficulty of explanation in terms of conscious states (the Law of *Affect*), and (b) upon the assumed impossibility of backward neural action. Muenzinger (90) accepted the Law of Effect as empirically sound, but, like Thorndike, argued for a single law which will apply equally well to rats and to humans. His Law of Effect contained two parts, in addition to certain special empirical laws which were illustrated: "Not only does a successful response itself tend to be repeated, but also the contiguous responses before and after it," and "Failure tends to vary a response and also the contiguous responses before and after it."

Effect of reward—All participants in the symposium referred to above accepted the evidence as confirming the influence of success (reward, satisfyingness, or whatnot). Culler (30) believed that the positive effects are due to reactivation of the mechanisms which have just been stimulated, hence causing impression and memory. New data on the influence of reward were reported by Gilliland (50), who worked with two groups of rats under conditions in which recency and frequency were controlled. Gilbert (48, 49) showed experimentally that even noninformative shock (that is, shock administered so as to indicate neither success nor failure, and hence to eliminate guidance) had measurable values in expediting learning.

Effect of punishment—Brown (9) objected to the doubt now generally held with regard to the effect of punishment on learning. He insisted that this negative position does not agree with common sense; punishment in everyone's experience does work. Moreover, he pointed out that certain data in a study by Tolman and Honzik, but overlooked by them, supplied evidence that punishment tended to the elimination of unsuccessful responses.

Other experimentations on the Law of Effect—Gurnee (56) got no statistically reliable differences between light, moderate, and no shocks in learning a bolt-head maze. Courts and Waggoner (28) concluded from their

study that the effect of a response on subsequent learning is contingent upon the information it furnishes with regard to success or failure. In the absence of definite information of this kind the effect in a trial-and-error situation tends to be interpreted as indicative of success. Using the paired-associate technic with words and unrelated numbers, Muenzinger and Dove (91) observed that in serial learning success produced a gradient of uniformity of behavior, while failure produced a gradient of variability of behavior, thus verifying Thorndike's statement with regard to the spread of success (cited above).

Mowrer (89) suggested a modification of the Law of Effect to include sets and anticipatory tensions. He held that annoying or punishing situations do not themselves serve to influence stimulus-response connections, but rather that they increase the anticipatory tension which in turn motivates opposite responses. R. White (150), working along the same line, proposed an addition to Hull's goal-gradient hypothesis, namely, that the completion of a fractional anticipatory reaction tends to reinforce recent and concomitant connections. After tracing the history of the Law of Effect in Thorndike's formulation and reformulation of his learning theory, Waits (139) tested the validity of Thorndike's current position in an experiment in which the learning situation was "retained" (that is, maintained before the subject until he had made the correct response). The material used was paired associates of words and unrelated numbers. Success was found to strengthen connections, as expected, and punishment (failure) seemed to furnish no information useful in later trials and did not eliminate wrong responses.

Other "laws"—The effect of primacy in learning nonsense material was studied by Raffel (104), learning and recall being varied in four different ways. In one of the conditions primacy was stronger than recency; in another, there was no primacy effect. The Gestalt principle of least effort was investigated by Waters (143) and, as formulated by Wheeler, was found to be not invalid, but of restricted application.

Conditioning

The extent of interest in conditioning is perhaps best revealed by Razran's bibliography (108) which contains no less than 1,111 references, all published prior to 1937. Experimental and critical interest in conditioning has not declined during the last three years, though the bibliography for this chapter contains but a few of the many reported studies. The C-R technic, while most frequently applied to subhuman animals, was also applied to humans, in connection both (a) with reflex or involuntary adjustments, for example, the pupillary response (1), the eyelid response (65), salivation (107, 155), and the galvanic skin reaction (70); and (b) with voluntary processes, such as "paying attention" (21), turning a handle upon presentation of the primary stimulus (111), selective response of keys

upon buzzer signals (129), and (less clearly a case of conditioning) learning the names of pictures (38). In the case of the latter group of studies most if not all of the phenomena associated with the conditioning of involuntary responses were observed, as had been the case also in numerous earlier studies of this kind cited by Razran (109).

The significance of conditioning for learning theory was variously assessed. As has already been stated, some regarded conditioning as the prototype of all learning. Thus, Holt was quoted as believing that the conditioned response "is the true psychological as well as the physiological law of association" (68: 61). At the other extreme, Razran was quoted in the same reference as believing that ". . . to say that one's learning is no more than mere conditioning is more of an insult than a theory. . . ." Stephens (129) held that unless the C-R theory can explain the *direction* of conditioning (which R will be attached to which S), then it adds nothing to the old law of association by contiguity. He then attempted experimentally, but without success, to determine the nature of dominance which can account for the relative potency of S's.

Elaboration of the concept—Several psychologists (Tolman, Zener, Culler, and Razran, in particular) insisted that the experimental facts of conditioning have been greatly oversimplified. On the basis of his experimental work, largely with rats, Tolman (133, 135) suggested the necessity of positing "intervening variables," such as demands, appetites, hypotheses, etc., in place of Thorndike's stimuli, connections, and response tendencies, and in place of Hull's conditioning, goal-gradients, and anticipatory goal responses. The first of the two references contains a valuable bibliography of 153 items.

Observation of a wide range of behavior of the salivating dog, and not alone of the behavior obviously related to the C-R, led Zener (155) to reject simple conditioning as an explanation of learning and to substitute therefor a sign-urge theory. Salivation was found to reveal itself as a dependent component within a complex, widespread, organized, goal-directed behavioral act, which varies adaptively with changes in the experimental situation. Salivation then is incorrectly understood as an isolated unit quite unaffected by accompanying adjustments and by the totality of the stimulating conditions. Culler (31) came to similar conclusions. He also was particularly interested in changes in the C-R (salivation) during the process of conditioning. The response was seen to be something quite different at first from what it eventually became. In its initial form the response meant "readiness for something; the problem being not yet clear, the response is not yet defined; and so the animal reacts in a way suitable for a large class of stimuli" (31: 105). Thus, the salivation response had as its function, "not to react to the unconditioned stimulus itself, but to get ready for it, to make preparatory adjustments for an incoming S."

Salivary conditioning in the case of humans was studied by Razran (107). The behavior of his subjects in the experimental situation revealed

unmistakably the importance of other factors than the conditioned stimulus and the unconditioned stimulus and led him to stress central factors (set, attitude, etc.) in human as contrasted with subhuman subjects.

Confusion, both in organizing and in interpreting experimentation, arises, according to Skinner (125), from failure to distinguish between two types of conditioned response, the "respondent type," in which the response is elicited by some specific stimulus (this is the classical type of conditioning), and the "operant type," which is emitted, as it were, by the organism, which is not made to a specific stimulus, and which involves the reinforcement of the response. Since then Skinner (124) elaborated his position in a nonneural, exclusively behavioral description of the learning process. Emphasis was laid upon operant conditioning in a conception of learning which is nearest like that of Tolman.

Appraisal of conditioning—The most complete and thoroughgoing evaluation of conditioning was reported by Hilgard in a series of three articles. In the first (66), conditioning was considered as equivalent to stimulus-substitution, and the research, both supposedly contradictory and supposedly confirmatory, was reviewed and analyzed. His conclusion was that simple stimulus-substitution must either be abandoned or be supplemented with other concepts. The second Hilgard reference (67) was devoted to a consideration of four alternatives to substitution of S, as accounting for conditioning:

(a) Certain amendments suggested to this fundamental law of association by contiguity (such as the notion of dominance, of time sequence, of attitude or set, of verbalization, and the like) serve only to call attention to the complexity of stimulus-response relationships and to introduce terms which are foreign to the logic of stimulus-response.

(b) Teleological substitutions for association by contiguity cannot be denied on the basis of inapplicability; they can be objected to only on logical grounds.

(c) Explanations in terms of the physiology of adjustment were opposed as containing parts of the objections to the first two alternatives.

(d) The correlation of discoverable antecedents with measurable consequents and the statement of the results in mathematically expressed relationships was the interpretation favored by Hilgard. A sample of this procedure was supplied by him later in connection with conditioned discrimination with human subjects (64).

In the third of the three articles (68) Hilgard discussed conditioning and conventional learning experiments—problem box, maze, memorization of verbal materials, insight, and problem solving. He pointed out five theoretical positions which may be taken with respect to the relation between conditioning and other forms of learning, namely, (a) the view that the C-R is the unit of habit, (b) that conditioning is a substitute for association, (c) that it is only representative of other forms of learning, (d) that the "laws" of conditioning are merely deductive principles, and (e) that conditioning is but a subordinate and restricted form of learning. The article concluded with a bibliography of 243 titles.

Organization in Learning

Effect of instructions and knowledge of success—In an experiment with paired words and numbers it was found that general knowledge of success such as provided by the experimenter's statement, "You had five right," had little effect. What seemed to be needed was more definite information given at once as to specific successes and errors (113). Knowledge of success immediately verifiable by the learner was helpful in another experiment (41) in learning to direct a beam of light upon a bull's eye target. The importance of the learner's attitude was clearly revealed in studies by Marrow and by Moore. Marrow (86) found that his subjects recalled uncompleted paper-and-pencil tasks 57 percent better than they did completed tasks. A second experiment with other materials verified the conclusions from the first. The explanation seemed to lie in the nature of the task with respect to its possibilities for subjective as contrasted with external completion. J. H. Moore (87), working with sense and nonsense material, geometric forms, pictures, colors, and puzzles, showed that the tendencies set up in his subjects by means of instructions were unquestionably influential in determining success in learning.

That instructions in maze learning are not always helpful was shown by Scott (119). His subjects who were taught a 6-unit maze and then told how to organize their learning verbally did better on a 10-unit maze which included the original 6-unit maze than uninstructed subjects, but they did no better on an 18- and a 27-unit maze. Apparently the "whole" on which instruction had been given was lost in the larger patterns.

Set, without instructions—Two studies by Line and Wees (83, 145) revealed the role of the "principle of determination" in reproducing (a) a story in which an incomplete beginning was followed by random ideas, (b) a connected story, (c) the same with statements in reverse order, (d) an inconsequential succession of statements, and the like. In (a) children adopted the direction suggested in the beginning and completed the story consistently therewith; in (b), (c), and (d), so far as perceived relationships were determinable, reproduction conformed to these relationships. The tendency for the learner to find for himself some principle of organization even in mastering nonsense syllables was observed by Raskin and Cook (105); and in mastering unrelated pairs of words and numbers, by Thorndike (131). Perhaps the same phenomena are to be found in latent learning, investigated by Eaton (39) and by Porter (102). In both of the latter instances the experimental subjects gave evidence of having learned material to which they were supposed to be reacting in a nonlearning manner; their latent learning may represent the functioning of secondary sets established by many previous experiences in situations identical save for the fact that then learning was the primary purpose.

The process of organization—Something concerning the nature of organization was determined, largely through introspection and interview, in ex-

perimental situations where the subjects were not told to organize their learning but nevertheless attempted to do so. Langer (81) set the task of learning which of ten visual stimuli corresponded to each of ten telegraphic keys. Reports by the subjects indicated that they tended to "schematize" their learning; they did not seem to eliminate gradually errors on all associations at the same time, but rather acquired one association at a time while the others remained largely unchanged. In Langwell's experiment (82) three types of learning were studied—rolling balls into an inclosure, learning various silhouette figures, and mirror tracing. In each case introspective accounts showed that the subjects tried to organize the learning material according to some effective plan.

The acquisition of verbal habits by repetition was studied by Oldfield and Zangwill (93). Three types of prose—normal, ungrammatical, and inconsistent—were learned through repetition, and at various stages the subjects explained what they were doing. The authors suggested that in the first stage of learning there is found a very general scheme which incorporates a certain amount of dominant detail. In later learning this scheme is progressively differentiated and organized until it finally mediates literal recall of the material learned. This account has much in common with Krechevsky's analytical study of discrimination in rats (78), according to which in the "pre-solution period" the animals respond to various irrelevant stimuli and solve only subsidiary problems.

"Insight" in learning—Several studies purporting to study "insight" in learning were reported; these will be summarized in Chapter II. Pickford (99) was impressed with the gradual appearance of insight during a pre-solution period devoted to hard thinking. On the other hand, Schooley and Hartmann (118) commented on the sudden appearance of insight in their subjects. The explanation for the difference in these two studies probably lies in the difference in the experimental settings. In the former study solution was dependent upon the discovery of a relationship by no means evident to the unsophisticated subject. By contrast, Schooley and Hartmann's subjects were probably well started toward an understanding of the relationships involved (action-agent, agent-action, attribute-substance, substance-attribute, etc.). Unlike these investigators, Spence (127), who worked with rats in discrimination experiments, found no usefulness in the concept of insight as a special process; his rats' pre-solution activity seemed explicable in terms of trial-and-error theory.

It may not be inappropriate in this connection to refer to other studies which stressed the importance of internal or subjective factors in learning. Snygg (126) experimented with tasks which were mechanically equivalent, involving opposites, nonsense syllables which could and which could not be made into poems, number series, and geometrical figures. These situations were found to vary in difficulty, and their relative difficulty seemed to be attributable to the way in which they were experienced by the subjects. Likewise, the problem of whole-versus-part learning was redefined by

Seagoe (120, 121) and by Northway (92). Both investigators objected to any conception of "wholeness" which relied upon objective unity and they produced experimental data which showed "wholes" to be subjective constructs. Higginson (62) used a maze which his fifteen subjects learned four different times, the maze being rotated through 90 degrees after each trial. His subjects had information of these changes, and this knowledge was responsible for marked economy in the successive learning situations. Somewhat similar results as to economy were obtained by Brown (8), who interrupted his subjects after they had learned part of a maze and then had them learn the maze again with certain changes in the middle of the pattern.

Physiological Correlates of Learning

The research in this area can be no more than illustrated; nevertheless, it seems desirable to mention a few studies on certain aspects of the problem.

The effects of artificially induced tension (support of weights) during the learning of nonsense syllables were found to be variable by Stauffacher (128). The good learners seemed somewhat inhibited, but the poor learners actually benefited. Similar findings were obtained in a study by Bills and Stauffacher (4), in which tension was voluntarily induced and in which learning consisted of the problem-solving variety. It was suggested that good learners habitually perform at a rather high tension level, increases in which are harmful, whereas poor learners customarily work at too low a tension level and hence are helped by an increase in tonus. During the learning of two speed tasks involving the same eye-hand coordinations, subjects were found to maintain steadily a certain tension level, as measured by pressure on keys (47). After learning, however, the tension level was markedly decreased. The effect of introducing a variety of distractions during learning was studied by Cason (20). While his subjects learned word associates, the experimenter moved about the room, snapped gum, scraped chairs, and the like. The effects of these distractions, the precise physiological character of which was not known, were in general harmful.

Certain physiological changes in successful and unsuccessful problem solving were investigated by Clites (23, 24). Subjects were required to solve the second water-dipping problem in the Stanford-Binet. Successful solution was marked by lowered skin resistance and by decreases in muscular movements and in grip tension. It was possible by Clites' technic to make observations with regard to these functions for different kinds of subjects and at different times in the progress of learning.

Psychologists now tend to look much less than formerly to the concepts, facts, and hypotheses of neurophysiology for explanatory principles in the field of learning. This change, already hinted at in some of the foregoing sections of this chapter, is explicitly confirmed by statements of Dashiell (32) and McGeoch (85). Nevertheless, Chappell and Pike (22) held that

neuropsychology has accumulated some data of large significance for learning theory. In particular, they mentioned the experimental evidence against the traditionally oversimplified three-neurone arc as the neural unit in learning. This evidence relates chiefly to the new importance attached to the nerve cell (instead of the synapse) in neural functioning and to the increase in size of the nerve itself under conditions of learning.

Educational Applications—Discussions and Experimentation

Dashiell (32) summarized the facts of the psychology of learning which are of importance to the educationalist. Education was viewed as guided habit-formation. Organized habits were regarded as something "vastly more than a chain of reflex arcs joined by the cement of kinesthetic impulses. Any well-learned performance remains a variable and adaptable performance" (a view of habit shared by Evans (42) by reason of his work with rats). The overemphasis on the random, hit-or-miss, unanalytical character of learning was decried, and support was given to a conception in which solution follows the attentive scrutiny of the field as a whole and the perception of crucial relationships with it. The danger of oversimplifying the process of conditioning was stressed, the roles of reward and punishment were described, etc.

Dickey (36) saw changes in the organization of instructional materials and methods in arithmetic as direct applications of Gestalt psychology. Brownell (10) pointed out two types of learning in arithmetic—that by repetition, which serves to increase smoothness, quickness, and accuracy of performance at whatever level of performance, and that by "insight," which emphasizes understanding and leads to the adoption of steadily higher levels of performance. A somewhat similar distinction was made between practice and true learning by Gemelli (46). Research on the function of meaning in learning was reviewed by Reed (110) and found to be disappointing in its volume. Werner (148) wrote instructively on the problem of process and achievement in learning—and hence in education. He held that learning must be viewed longitudinally, the learner's process rather than his product being the true measure of growth and achievement.

In a stimulating volume Judd (75) brought together research data and his own psychological views to support his position that education must be conceived of as "cultivation of the higher mental processes." Among the data cited were coefficients of correlation between mastery of factual content on the one hand and ability to apply facts, to infer from facts, and the like, on the other hand; classifications of learning assignments in typical science textbooks; tabulations of various vocabularies according to parts of speech, in order to show the importance of words expressing relationships, and so on. In Chapter VIII Judd renewed his attack on Thorndike's research and point of view with regard to learning and education and called for a new orientation in educational psychology.

Johnson (74) studied the effect of examinations on learning and on retention. She administered periodic tests to her experimental subjects, but none to her control subjects. On the term test the experimental subjects scored higher than did the non-examination subjects, but this superiority was not maintained when the test was repeated somewhat later to secure retention measures. The author noted the agreement of her findings with those of other investigators and the fact that apparently periodic examinations motivate only temporary achievement. The effects of self-directed as opposed to formally guided learning were studied in a control-group experiment conducted by Huxtable (73) on one hundred junior high-school students. Measures were derived from tests on vocabulary, on reading comprehension and interpretation, and on evaluating compositions. No reliable differences between her two groups were obtained, which she explained as due to similar "felt needs" on the part of both experimental groups. All the students had long been enrolled in a school which emphasized self-direction. C. Hall (58) undertook to discover whether there is a general learning ability, using the technic of correlation with measures on four tasks: a stylus maze, Peterson's rational learning problem, nonsense syllables, and a punch board maze. His subjects were one hundred college women. The intercorrelations were all positive, but low, as in previously reported studies of a similar kind. He ascribed the low coefficients to differences in motivation, previous experience, etc.

Interpretation of Research

Among the trends to be noted in psychological discussion and experimentation on learning theory are: (a) the emancipation of the psychologist from dependence upon neurophysiology for explanatory principles, in favor of behavioral and operational principles; (b) the more general recognition of the complexity of behavior, as contrasted with earlier oversimplifications; (c) the greater importance attached to goal-seeking and tension-reduction as dynamic to learning; (d) the larger place assigned subjective factors in defining learning situations and hence in accounting for learning behavior itself; (e) the increasing tendency to view habits and the response complexes of learning in less rigid and less inflexible terms; (f) the more common effort to seek relationships among apparently unlike positions and theories; and (g) perhaps the assent to the need for admitting differences between humans and subhumans in learning.

To be sure, these may be only assumed trends. For example, with regard to (g) Rexroad (112) said, "There is a general feeling among psychologists, and the writer concurs in this belief, that the difference [between human and subhuman learning] is mainly or entirely in the number and kinds of sets underlying man's trial-and-error efforts." Tolman (135) stated, "I believe that everything important in psychology (except perhaps such matters as the building up of a superego, that is, everything save such

matters as involve society and words) can be investigated in essence through the continued experimental and theoretical analysis of the determiners of rat behavior at a choice point in a maze." On the other hand, Razran (107) felt that both experimental findings and theoretical considerations support the fact of qualitative differences in humans and infrahumans and the absolute necessity for taking these differences into account; otherwise, laboratory artifacts are created and the essential determining factors in human learning are ignored. It may be noted that Rexroad and Tolman also recognize differences between humans and lower animals, Rexroad emphasizing matters of attitude and set, Tolman matters of language and other kinds of social stimulation. Tolman's concession of the importance of "society and words" serves to call attention to the particular learning factors which are peculiarly the properties employed in formal education. It was precisely for the purpose of capitalizing on language and social stimulation that the school was organized and set apart, the better to assure the verbal and emotional development of the individual.

If the trends which have been listed above are actual, there is reason to believe that psychology is about to make valuable contributions to the practical enterprise of education. So long as learning was conceived as a blind, hit-or-miss affair, psychologists could offer little that was helpful in the directing of children's learning, for even casual observation revealed that children (at least those who knew what they were about) did not learn in this way. So long, too, as learning was thought to be the establishment of simple and definite responses to stimuli equally simple and definite (no matter how valid this conception may be in terms of *ultimate* analysis), psychologists helped little, for obviously children were faced not by a stimulus but by a complicated problem situation, and they responded not by a single simple reaction but by a complex reaction. Little help, also, was to be found in neural descriptions and explanations, for the school deals not with neurones but with experience; and there was little help either in learning theory which neglected the dynamics of behavior and so supplied no basis for understanding and for providing proper motivation. Now that psychologists are inclined to treat learning in behavioral terms, they will be using a language which is more intelligible to the educationalist.

Educationalists will welcome the time when psychologists give a greater share of their attention to learning problems which are like those of the school. Psychologists are still fond of experimenting with mazes, with discrimination and puzzle boxes, with conditioning to relatively simple stimulus situations, with nonsense syllables, with paired associates of unrelated words and numbers. They still neglect—or so it seems to the educationalist—the more significant kind of human problems, namely, those which relate to behavior in a meaningful problem situation in which the "higher" mental processes are called into play. The typical psychological experiment is planned so that "insight" is practically impossible and the subject, human or animal, can progress only by guessing and then somehow

by retaining the correct guess. While too much school learning resembles this model, the aim of the school is away from such kinds of learning and, accordingly, the educationalist is eager for whatever suggestions he can find to help him with respect to learning theory.

Educational investigators likewise have faults in their research outlook, somewhat in the opposite direction. In studying problems related to immediate needs, they tend to so circumscribe research that its general usefulness is unnecessarily limited. Thus, one investigates the function of phonetics in reading or of visual aids in geography to ascertain what should be done in the particular school situation. This is unfortunate, for the educationalist has opportunities for much wider service by way of contributing to general learning theory. These opportunities are the greater because the processes and problems with which he deals are as yet unattractive to the psychological investigator. It is perhaps not too much to hope that more students of education may be led to take this larger view of their opportunities.

Transfer of Training ²

Practical Surveys and Theoretical Discussions

Studies in formal discipline were divided into three classes by Hamley (60): those dealing (a) with sensory and perceptual experiences, (b) with mental activities such as memory, observation, and reasoning, and (c) with methods of teaching and the relative disciplinary values of various school subjects. His survey of the experimental work led to the general conclusion that transfer of training depends upon the conscious acceptance by the learner of methods, procedures, principles, sentiments, and ideals. In a comment upon Hamley's article, Phillips (97) warned against premature insistence on the acceptance of rules and ideals by the pupil before he has been presented with material of all kinds for him to assimilate, organize, and classify.

According to Cook (26) no adequate theory has been yet proposed to account for the phenomena of transfer of learning. From studies in cross-education, he separated explanatory theories into two types: dualistic and monistic. The former type of theory assumes that two kinds of learning are involved—pure habit, which does not transfer, and intelligent generalization, which does. The monistic theory type assumes that transfer is a function of the number of identical elements involved. So far as cross-education is concerned, Cook noted the transfer of "all kinds and degrees of learning." Britt (7) examined the three major theoretical explanations of retroactive inhibition in the light of experimental work and considered as most adequate Webb's theory (according to which there may be positive transference of facilitative and of inhibitive factors). Similarity, degree of learning, various conditions present during learning, etc.—factors which have been

² The writer is indebted to W. C. Rein, graduate student at Duke University, for substantial assistance in the preparation of this section.

studied in experiments on transfer—are present equally in those on retroaction, showing the close relation between these phenomena. To Bayles (3) it seemed probable that we transfer previous learning whenever and wherever we sense a later experience as being similar, more or less completely, to an earlier one. Current instructional procedures and the literature on transfer were examined by Breed (5) in the case of spelling and by Orata (95) in the case of mathematics. Both writers agreed that gains may be expected to follow upon instruction specifically designed to secure maximum transfer.

Laboratory Studies of Transfer

In their previously mentioned study of visual discrimination in rats (the only animal experiment included in this section), Gulliksen and Wolfle (55) attempted to predict the nature and accuracy of transfer of the learned response to new stimuli. Their prediction, mathematically stated, was that transfer may be expected to vary directly with the likeness or similarity of the learned and unlearned situations. Using nonsense syllables, Bunch and Winston (14) obtained positive transfer by pairing the original response syllables with different stimulus syllables. To secure negative transfer, the pairing was reversed, i. e., the initial stimulus syllables were matched with totally different response syllables. They found a lesser amount of retroactive inhibition in the retention of the original problem when the transfer was positive. In another experiment Bunch and McCraven (15) observed no tendency for the amount of transfer to vary uniformly with or against increase in time between similar tasks. Cook (25) investigated the relation between complexity and difficulty of solving Peterson's disc transfer problem. In the case of counterbalanced order, there was greater transfer from complex to simple than from simple to complex. Errors increased approximately according to the cube of the complexity; moves and trials showed slightly smaller increases.

A study of transfer of training in the learning of a complicated sensorimotor pattern by a trial-and-error method was reported by Langer (80). Because of marked individual differences in the presence, absence, or amount of transfer, an attempt was made to relate amount of transfer to personal characteristics. Extroverts tended to exhibit more transfer than did introverts, and this tendency was related to differences in the type of scheme employed in the learning of these kinds of persons. These findings with regard to the relation between transfer and personality types are suggestive for further research which gives more attention to the nature of the subjects used. Huang and Chang (71) taught their control groups one finger maze and their experimental subjects another maze, and then tested transfer with a third maze which had certain elements in common with that used by the experimental subjects. There was little difference between the two groups in learning the test maze—a fact which was interpreted as meaning that the experimental subjects saw the two mazes as different structural wholes. In

another maze study already referred to (62) the subjects learned a maze and then relearned it three more times, the maze being rotated through 90, 180, and 270 degrees on the successive trials. The subjects, knowing of these changes, made large use of this knowledge, as shown by markedly reduced errors in the second, third, and fourth learnings.

With the purpose of retesting the identity theory of transfer by means of psycho-physiological "elements" rather than logical ones, Freeman (43) selected typewriting as the test performance. From his negative results he concluded that transfer is not caused by identity of elements in any part of the reaction arc. Two studies employed the familiar star pattern in mirror drawing. Siipola (122) found that a group which observed the learning of another group was inferior to a bilateral transfer group but superior to a control group without previous practice or observation. J. E. Moore (83) compared thirty-three art students at the college level with ninety-five students who had had no art training and concluded that training in art transferred to mirror tracing, being most obvious during the earlier stages of the experiment. After practice in sorting cards according to a pattern marked by two-place numbers, Watson (144) shifted the positions of 0, 4, 8, 12, or 16 numbers or substituted 4, 8, 12, or 16 letters on the compartments, and the subjects sorted the cards according to the new pattern. In every instance except that in which the position of all sixteen numbers was shifted the transfer to the changed pattern was positive. The amount of this positive transfer decreased directly with shifting of numbers but remained constant as the number of letter substitutions was increased. Supplementary observations suggested that some of the subjects organized both designs into one comprehensive pattern.

Transfer in School Subjects

Brueckner (11) presented preliminary reports of two unpublished studies of transfer in arithmetic. In the first study his subjects learned certain simple multiplication facts in the direct order and showed a reduction of errors of 94 percent on the final test. At the same time they showed a reduction of 87 percent on the reverse multiplication facts which they had not studied. In the second study pupils were taught five steps in the addition of like fractions to almost 100 percent mastery. Transfer to the addition of mixed numbers containing these same steps was found to some extent but not enough to insure the learning of the steps with mixed numbers. Transfer to the untaught process was greatest with the highest, least with the lowest, group of mental ability. In another arithmetic investigation, Grossnickle (53) administered tests to 1,075 students in Grades V-XV, inclusive, and concluded that there was only partial ability to transfer a knowledge of fifty multiplication facts to their usage in the long-division process. However, "transfer of knowledge" was measured negatively in terms of transfer of errors, and,

so measured, these errors actually represented but a very small percent of the total responses.

Pupils who had had two years of Latin were found by Douglass and Kittelson (37) to be slightly better in spelling, vocabulary, and grammar tests than pupils of similar natural general ability who had not studied Latin. The small difference was assumed to be due to failure to teach Latin so as to contribute effectively to developing these other abilities. Pond (100), using a longer test, reported a positive biserial correlation between vocabulary scores of his subjects and their study of Latin. Admittedly the Latin group, however, was superior in general intelligence. Stright (130) gave specific training to an experimental group in reading for one hour per week during the semester and obtained reliably greater differences not only in reading comprehension scores but also in scores on the Cooperative Algebra Test.

The transfer of learning in elementary psychology (a) to the correction of popular misconceptions, and (b) to social science courses was investigated by McGarvey (84). A misconception test composed equally of "discussed" and "nondiscussed" items revealed reliable decreases of belief on both parts of the test by the experimental groups, indicating the presence of transfer. Control groups, who had had no psychology courses, showed unreliable decreases. There was, however, little difference in the changes in scores between the groups. A series of experiments in elementary science from kindergarten through Grade IX was reported by Croxton (29). His results indicated that many children in the higher primary, the intermediate, and the junior high-school grades are capable of generalizing. The findings offer implications for further research.

Ryans (114) cast doubt on the assumption that intelligence and positive transfer are correlated by showing that students with the higher intelligence test scores evidenced the greater amount of negative transfer in digit-letter substitution when the relationships were varied. His explanation was that the brighter students, being more retentive, encountered interference from previously learned materials. After giving initial tests in reading, sentence completion, disarranged sentences, vocabulary, and verbal analogies, Gordon (51) trained her subjects in the last named. She found no evidence that this training noticeably improved verbal ability or the general ability to see verbal relations. The transfer effect of the training was determined as incidental to, and not a distinct result of, the improvement in ability to solve analogies. Intelligence test sophistication was studied by Vernon (138) as a matter of transfer, not so much of common identical elements as of methods and principles. He found the mean increase of teacher-training groups, given instruction in tests and testing procedure, to be 11.3 sigma units. Equivalent controls made practically no change in score. These data led him to suggest the advisability of establishing two sets of norms for intelligence tests, one for novices, one for sophisticated testees. A rank

difference correlation coefficient of .89 was reported by Ray (106) between complete solution of problems (represented by elimination of errors and correct statement of generalization) and intelligence as measured by the Binet. There was also a positive relationship between low scores and frequency (a) of partially correct generalizations, and (b) of trial-and-error types of solution.

From the familiar puzzles of tracing geometric figures without crossing or retracing lines, or lifting the pencil from the paper, Graham (52) found that 55 percent of the 152 subjects were able to discover one or more of three good generalizations of the major premise type. Graham was convinced that education has too long neglected the development of skills in discriminating and generalizing, while it has overemphasized the applications of generalizations as a means of securing specific answers. Instruction in simple analysis, abstraction, and generalization was given by Barlow (2) between initial and end tests based on Aesop's fables. In ability to write the moral of the fables, he found transfer of 64 percent in children, 16 percent in adults. Barlow thought that "several factors lend support to the theory that general transfer takes place in the form of the learning curve." E. White (149), after giving lessons in logic, found appreciably higher scores in tests of reasoning, in an English construction test, and in composition. He inferred from the results "that lessons in logic do effect an improvement in habits of thought in school children."

Interpretation of Present Status of Research

As one reads the experimental and theoretical reports on transfer, one is impressed by the paucity of new data, of new research technics, and of new interpretative concepts. Investigators continue to report evidence of "positive," of "negative," and of "no" transfer. Only occasionally—as for example in the studies of Langer (80) and of Ryans (114)—do investigators desert the familiar pattern of experimental procedures, venture to study new variables or old variables in new ways, and attempt to ascertain the *nature* of transfer, the *method* of transfer, and the *factors conditioning* transfer. With equal rarity do the theorists yield challenging new hypotheses, apparently preferring rather to debate the old questions, such as the comparative merits of different explanations of transfer.

There will always be different positions (for example, with regard to the mechanisms of transfer) so long as psychologists hold to markedly different views concerning the subjectmatter of psychology; but many of the problems which intrigue the psychologist and which may in a sense be truly fundamental are essentially nonexistent for the educationalist.

For example, we may consider a single illustration, namely, the general question as to whether there is such a thing as transfer. The statement, often made, that transference sometimes occurs and sometimes does not occur is based upon the assumption that transference, if present, always

reveals itself unambiguously. This assumption may be questioned. After all, what we have in the new situation is an exceedingly complicated response, so intricate as to prevent complete analysis and the identification of every item of the behavior involved. In these circumstances actual facilitation at certain points may be masked or even counteracted by the preponderant effects of interference at other points. The net result may be what has customarily been called "no transfer" (when the facilitating and interfering factors balance and so cancel each other) or "negative transfer" (when the factors of interference overbalance and outweigh the factors of facilitation).

It is probably much nearer the truth to say that there is always transference of learning from one situation to another, as was pointed out by Carr more than ten years ago (see also McGeoch, 85:110). Such certainly must be the implications of the new emphasis upon "insight" in learning and the reinterpretation of the concept of trial-and-error. The organism, faced by a strange situation, tends to react relevantly to that situation. That is to say, it transfers modes of reaction which in past experience have been appropriate in similar settings. We cannot say why this is so, other than to state that this is the way the organism works. Nor can we predict which of the many possible responses will be made (for there are a great many); nor yet again can we foretell the consequences of the transference. These consequences may be harmful, in which case we speak of interference and negative transfer; or they may be helpful, in which case we speak of facilitation and positive transfer. Whether harmful or helpful, the transference may be the same phenomenon, to be accounted for (however that may be) in precisely the same terms. The task in education under such a theory is to strive to see that the factors making for facilitation are maximum while those making for interference are held to the minimum.

CHAPTER II

Types of Learning and General Conditions Affecting Learning¹

GUY T. BUSWELL

WHEREAS THE FIRST CHAPTER dealt with the theoretical aspects of learning, this chapter will review studies of particular types of learning and general conditions which affect learning. The third chapter will present studies which are primarily concerned with motivation of learning, with individual differences, and with the relation of general intelligence to learning. Some of the most useful studies of learning have dealt with school subjects, as reading and solving problems in arithmetic. Since, however, another issue of the *Review of Educational Research* is devoted specifically to the psychology of school subjects these studies are omitted from consideration in this chapter. Studies reported here which relate to the learning of school materials are included because they touch aspects of learning which have wider implications.

Reviews of Studies of Learning

Experiments dealing with meaningful verbal materials were reviewed by Welborn (235), who pointed out significant differences between logical and rote memory. The curves of learning in the two cases differ radically. The study indicates the conditions which do or do not influence learning of this type. A bibliography of 81 titles is included. Spence (228) summarized the literature relating to learning and the higher mental processes in infrahuman primates. He appended a bibliography of 161 titles. Studies of conditioned responses were brought together in a classified bibliography by Razran (217) which includes more than one thousand titles. Many of these studies are significant for research in education. Experimental studies of thought and reasoning were summarized by E. Gibson and McGarvey (171). The review gives an excellent background for students who contemplate work in this field. Blankenship (159) reviewed the literature relating to memory span, noting a long list of factors which influence this type of learning. G. Gilbert (173) summarized a group of twenty experiments published since 1929 which dealt with the relationship of feeling to memory.

Learning To Solve Problems

Ten studies were found which deal more or less directly with problem solving. Durkin (167) conducted an experiment with 28 subjects in learn-

¹ Bibliography for this chapter begins on page 318.

ing to solve two-dimensional construction puzzles. He was particularly interested in the processes of trial-and-error, gradual analysis, and sudden reorganization, which he found made up the three main types of solution. He found that the processes of observation, recall, seeing relations, and attention to the goal characterized the learning process. An investigation carried on by Schooley and Hartmann (220) was concerned particularly with the role of insight in the learning of logical relations. They found that learning standard logical relationships such as part-whole, genius-species, etc., occurs suddenly and apparently with permanent mastery rather than by a slow process of trial and error based on much practice. The subjects were children at the beginning school age. Still another study on insight was reported by Pickford (212). Fifteen subjects were asked to find the common feature, which happened to be a right angle, in 14 members of a series of 27 simple straight-line figures. Insight seemed to develop by steps, some of which were not conscious. There was large difference in the suddenness with which insight appeared and the pre-insight period seemed to be occupied by rational thinking rather than by trial-and-error responses.

Kuo (187) checked the results of some previous studies of insight by using an animal maze experiment. Maier (200) formulated a theory of reasoning which would include both animals and humans. He cited experiments on both animals and humans to illustrate the points of his theory and held that insight may or may not accompany reasoning. Furthermore, he held that good learning ability and good reasoning ability are not necessarily correlated highly and that outstanding discoveries in science may be made by men without a background in that field, or by young men, or in moments of inadvertence. He conceives of reasoning as a creative ability. Graham (177) reported an experiment with a unicursal puzzle. Graham found that when generalized discriminative types of acts were suggested as subgoals in the learning the incidence of success increased by from 300 to 500 percent. This finding of a value in analyzing the major goals of problem thinking into minor goals has widespread implications for education. Hollingworth (181) carried on an experiment with bright nine-year-old children using verbal materials. The children were required to make words out of specified groups of letters which in some cases were already arranged to form other words and in some cases were simply arranged in nonsense patterns. Letters already grouped into words, that is, "gestalted," produced higher scores than did the words arranged in nonsense patterns.

The age at which children learn to reason was studied by Maier (199) by measuring their ability to combine the essentials of two isolated experiences in order to reach a goal. For this particular experiment Maier found that ability to do the necessary reasoning was rarely developed in children below six years of age. One must, however, interpret this result with caution and must avoid generalizations which go beyond the scope of Maier's ex-

periment. Two studies of reasoning ability were carried on in classroom situations. White (236) observed the effect of adding one hour per week of instruction in logic for one of two paired classes in grammar. At the end of a three-month period the value of instruction in logic was shown by appreciably higher scores in tests of reasoning ability in an English construction test and composition. Sells and Koob (225) showed some results of a group demonstration of the "atmosphere effect" in syllogistic reasoning.

The Relation of Practice to Learning

As usual, the study of conditions affecting the practice curve in learning led to a considerable number of investigations. Six of these had to do with some aspect of the distribution of practice periods. Travis (231, 232) reported two studies on this problem. In the case of motor learning he found that with a constant practice period of five minutes a 20-minute rest period was more effective than one of 5 minutes, 48 hours, 72 hours, or 120 hours. Patten's research (210) was on the influence of mass and distributed repetition in learning nonsense syllables. His subjects were college students, half of whom studied by mass practice and half by distributed practice. The advantages of distributed practice were consistent for the various factors into which the learning process was analyzed. Ransom and Skaggs (215) were concerned with the effects of three different distributions of practice in learning two Goddard form boards. One group worked the board 20 times a day for 5 days, a second group 10 times a day for 10 days, and a third group 5 times a day for 20 days. The data did not show any clear-cut evidence of the superiority of the more distributed form of practice. The authors offered as an explanation that in the more distributed forms of practice it was more difficult to maintain interest and effort than where the practice was massed into fewer days. Another investigation of the distribution of practice periods was reported by Cook (163) using finger mazes of four-, eight-, and twelve-unit patterns. He found that the effects of distributed practice varied according to the complexity of the maze pattern. Massed practice tended to be more economical in respect to errors with the small mazes and, conversely, distributed practice was superior in total time in the complex maze patterns. Easley (168) attempted to generalize the data relating to the curve of forgetting and the distribution of practice. He considered that the rest pauses were beneficial due to the fact that wrong responses are forgotten more rapidly than are correct responses, since they occur less frequently and are less well learned.

A miscellaneous group of studies dealt with various aspects of practice. Woodrow (239) studied the effect of a fixed change in difficulty upon perceptual learning, certain constant relationships being found. Langdon (189) investigated the effect of practice with simple motor tests. In this same field of motor skills Poindexter (213) studied the effects of the

Alpha, Beta, and Gamma postulates in learning to use a typewriter. He found that repeating the correct response (Alpha postulate) produced superior results as compared with repeating the incorrect responses (Beta postulate) an equal number of times. Research on reminiscence and rote learning was reported by Ward (234) who made use of nonsense syllables. Lough (192) noted the effect of functional periodicity on the learning process, using 96 women students as subjects. No differences were found in learning for the four phases of the menstrual cycle. Hovland's (182) research was on the effects of various speed presentations of nonsense syllables. Other studies (156, 209) dealt with the acquisition of verbal habits and with various methods of serial rote learning.

Most of the research on practice reported in the previous paragraphs serves only to extend or verify previous findings. In most cases they deal with simple elementary mental processes and are not directly applicable to school problems. Many of them reflect an atomistic view of learning in contrast with the type of experiments which would be set under a Gestalt theory. The general impression which the reviewer gains from the studies reported is that much experimentation is being carried on with little reference to the general field of learning and, consequently, it makes only a limited contribution to an integrated view of learning.

Whole-Part Learning

During the three-year period covered by this abstract, six studies were reported which dealt with some aspect of the problem of whole-part learning. Jensen and LeMaire (184) presented several selections of prose and poetry, which had been equated in difficulty, to 648 children, using either the whole or the part method of learning. They found the whole method superior for poetry but no difference in the effectiveness of the two methods as far as learning prose is concerned. Northway (208) studied the learning of poetry by whole and part methods, using children at three different school levels. The materials which he used were of different degrees of difficulty. The whole method was observed to be most advantageous, particularly when a poem is readily understood as a whole, but some interesting differences were noted in the nature of learning between the easy and difficult materials. Cook (165), in his investigation of whole-part learning of mazes with blindfolded subjects, used only three subjects but they learned 38 patterns of four sizes. The results from whole and part methods of learning differed in the earlier as compared with later trials, but while there was little difference in the relative value of part and whole methods on the first trial, on later trials the part method was superior in errors and the whole method superior in time. Cook's further research (164) in maze learning yielded substantially the same results as the earlier study.

Whole and part methods of solving jigsaw puzzles were studied by Crafts and Kohler (166), using 100 subjects. With six variations of

the whole-part methods they found a mixed method better than either the whole or the part method alone. However, the nearer the mixed method approached the whole method the better it appeared to be. Seagoe (222, 223) reported a series of laboratory experiments with quantitative wholes using mirror drawing, number codes, block designs, and test patterns. She found that "when a whole is defined as a Gestalt with important inner relationships, and when that unit involves a relatively large ideational factor, the material is more economically presented as a unit rather than as segments." In a further article Seagoe (224) presented a critical discussion of whole-part learning in which she proposed that Gestalt psychology offers a definition of a "whole" which could be used with advantage in studying the whole-part program.

Other Conditions Affecting Learning

The studies on conditions affecting learning are so varied in character that it is difficult to group them in subclassifications. In fact, the scattering of research on this phase of learning furnishes a good illustration of the basis for the frequent charge that research proceeds with little regard for the previous state of knowledge in the field or for the necessity of rounding out the weak spots in a given field. Furthermore, many of the experiments dealt with simple mental processes which throw little light on the character of abstract learning with which the school is primarily concerned.

The relationship between speed and accuracy in learning appeared again in a study by Philip (211). In three motor tasks of increasing complexity the relation between accuracy and errors proved to be curvilinear and inverse. Grossman and Cason (178) attempted to find the effect of a brief preliminary examination of material before the main period of study. They compared thirty minutes of massed study with six minutes of preliminary survey followed by twenty-four minutes of intensive learning. His results did not show any positive value of the preliminary examination of material. It should be noted, however, that the total time for study was short and that the preliminary examination consumed actually 20 percent of the total time allotted.

Porter and Hall (214) found that an emphasis on correct responses produced better results than an emphasis on incorrect responses when applied to the learning of a telegraph code. Similar results in an experiment dealing with maze learning were reported by Silleck and Lapha (226) in which the sounding of a bell to accompany correct responses was more effective than when the sound accompanied incorrect responses. Studies in the same general field have been reported by R. Gilbert (174, 175) and by Travis and Anderson (230). The particular problem dealt with here was the effect of informative and noninformative electric shocks. The results of the experiment were not entirely consistent.

A problem which has a good deal of practical importance for school procedure was studied by Mathews (202). He measured the results of three methods of studying upon immediate and delayed recall of the material. The methods were: (a) study without note-taking or underlining; (b) underlining the text; and (c) making an outline during the period of study. Little difference was found in the effects on immediate recall but for delayed recall the first method, namely, studying without note-taking or underlining, was found most conducive both to factual memory and to reproduction of logical organization. With the emphasis which many schools are now placing on the examination system further studies of this problem would be significant.

Loder (191) investigated aural learning with and without the speaker present. A speaker presented a body of factual material to eighth-grade pupils. One group heard the presentation directly from the speaker whereas the other group heard the presentation over a loud speaker in a different room. The immediate effects were in favor of the direct presentation but retention tests given at the end of twenty days and twenty-four days showed no significant difference between the two groups. The problem is one which warrants thorough study. Moore (205) studied the effect of certain purposes of learning which were included in verbal directions given by the experimenter. The results showed that purposes greatly influence the results of learning. The directness and clearness of the instructions given to the learner are important.

Retention and Recall

A major item of concern for any theory of education is the permanency or retention of the learning. Many of the studies on this problem were made in situations which are not common to the schools but since they relate to basic problems of retention the results of the studies have important implications for education.

One group of studies dealt with the retention effects of various school practices. Meyer (204) compared the effects of four types of examinations upon recognition and recall. Four matched groups of students in psychology were directed to study, respectively, for multiple-choice, true-false, completion, and essay-type examinations. Each group was then tested with the four types of tests after one day and again after a period of four weeks. Meyer found that the mental set occasioned by an essay examination was superior to the mental set produced by completion examinations. Furthermore, he found that the method of study was conditioned by the type of examination which was announced. In view of present practices in education, the implications of this type of study are broad. Bridge (160) sought to discover the effects of four different methods of learning on retention. The methods were sentence completion, written answers to a series of problems, talks given by children, and oral questioning. The subjects were

953 fifth-grade pupils divided into eight groups matched as to intelligence. The least effective method was found to be written answers to a series of problems, whereas the other three methods were found to be of about equal value both for immediate results and for recall after a month's time.

The relation of rate of learning and retention was studied by Gillette (176) in a carefully set up experiment involving 54 subjects. The evidence showed that the rapid learner is the better retainer even with various methods of learning. Schrepel and Laslett (221) reported an investigation of the frequently studied relationship between retention and summer vacation from school. One hundred and twenty-one pupils were given Form W of the Stanford Achievement Test in May and Form D fourteen weeks later. Only in the case of arithmetical computations were serious losses of subject-matter noted. Gains were shown in 14 of the 22 subtests. Pupils of greater mental age either lost less or gained more during the summer than the pupils of less mental age. The authors discussed the implications of their data for educational practice.

The statement is frequently encountered that nonverbal habits are retained longer than verbal habits. Van Tilborg (233) presented some data on the retention of finger maze and mental maze habits which support the conclusion that there is no significant difference in the two cases and that verbal habits are retained as long as nonverbal habits.

An interesting set of studies on goal tension and recall were reported by Marrow (201). He measured the amount of recall on finished and unfinished tasks, finding that the uncompleted tasks were recalled 57 percent better than the completed tasks. This initial experiment was then followed up by a second one in which he gave instructions to one group which led the group to interpret objective completion as nonfulfilment of intention and objective incompleteness as fulfilment of intention. In this case the superiority of 57 percent found in the first experiment was increased to 93 and to 71 percent, respectively, under conditions of the second experiment. While the implications for methods of teaching are not developed in the report, the findings are worthy of careful analysis and evaluation from this point of view.

Hanawalt (179) presented data on perceptual memory for figures which will be of particular interest to those readers who are concerned with experimental verification of the Gestalt theory. The relation of attitudes to recognition was studied by Zangwill (241). He found that where an attitude that marked the original presentation of a given stimulus was replaced by a different attitude on the re-presentation of the stimulus, recognition failed to occur with 63 percent of the subjects. In the control experiment in which no such attitudes were inculcated, recognition occurred with 90 percent of the subjects. The implications of the study are rather broad. McGeoch (193) carried on a study to discover whether reminiscence occurred in maze learning with kindergarten children. He used 241 pupils who were five years of age. He found no consistent or

reliable evidence of reminiscence in either of his two experimental groups. Lepley (190) reported on the effect of distraction upon retention tests. The influence of conditions prior to learning on subsequent recall were studied by Whitely and Blankenship (237). Northway (207) presented some interesting data showing the influence of age and social group on children's remembering. The data will be of particular interest to teachers of reading.

A stimulating study of the retention of social material was made by Remmers (218). Attitude tests were given to a group of high-school pupils before and after reading three propaganda articles. The tests were also given two days later, two months later, and six months later. The author pointed out that there is an original effect, a regression toward the attitude held before inoculation, and a wavering of the attitude for many months. While experiments of this type are difficult to control, they concern a field in which more light is needed.

Studies in Retroactive Inhibition and Interference

Among the various kinds of research in learning few have more implications for education than the studies of retroactive inhibition and interference. School programs are built for the most part with almost a total blindness in respect to this aspect of learning. Not only the sequence of topics within courses but the general organization of a program of education must eventually be made in the light of these matters. The research on retroactive inhibition at the present time is mostly focused on specific problems which, while basic to the work of the schools, are concerned with such situations and materials that it is difficult to point out the implications for education. This fact should not lead school teachers to the conclusion that this research is unrelated to school problems, but rather to the understanding that certain fundamental questions must be investigated before applications to a school program are possible.

Thorndike (229) reported a study on learning and interference using 112 pairs of words constructed in such a way that 80 of the first words in each pair rhymed with many other first words in the list. He used 61 subjects and found that the set of the mind established by the 72 rhyming words caused many errors in association. There was only one rhyming pair in the series, and yet one-sixth of the test responses were rhymed. The study illustrates neatly how an extraneous factor built up in previous experience may inhibit present learning.

McKinney (198) used a typical retroactive inhibition setup with a group of 50 subjects with advertisements for the materials of learning. The procedure was modified in various ways to throw light upon the factor of retroactive inhibition and the author discussed the theoretical significance of his findings. McGeoch continued his previous investigation with a series of studies (194, 195, 196, 197). This series of studies is one of the best in the literature and presents extremely significant implications

for education. Ray (216) pointed out the similarities between retroactive inhibition and certain other memory phenomena. Zangwill (240) interpolated a learning activity between exposures and re-exposures of a series of simple figures; the usual effects of retroactive inhibition were apparent. The influence of age, intelligence, and the duration of the interpolated activity was studied by Lahey (188). He used more than three thousand children from the third through the tenth grades of a school and employed as learning materials a series of 25 verbs taken from Thorndike's word list. During interpolated periods of different duration nouns were studied. The interval between the presentation of the interpolated activity and the recall of the verbs was given to group singing. The situation approached some of the common conditions of learning in school. He found that the amount of inhibition decreased as brightness of children increased. When brightness was held constant susceptibility to retroaction decreased with increase in chronological and mental age.

J. Gibson and Raffel (172) reported a technic for investigating retroactive and other inhibitory effects in immediate memory. They proposed that instead of emphasizing the laws of primacy and recency future investigations should place more stress on the possible inhibitory influences which bear upon learning.

Studies Dealing with Curves of Learning

Five studies had to do specifically with curves of learning or with characteristics of curves of learning. Kao (186) studied plateaus in the curve of learning in the development of motor skills, both simple and complex, by means of specially designed apparatus. He found short plateaus in the learning of simple tasks which he explained as due to various causes. In the complex task, wherever attention was directed specifically toward the separate factors in the task, the results showed plateaus in the learning curve, but where a complex task was such that the separate parts could not be singled out for special attention no plateaus appeared. Melton (203) investigated the end-spurt in memorization curves. He considered end-spurts to be artifacts due to the methods used in constructing average memorization curves rather than to any basic psychological principles of learning. He found that the curve of memorization was a continuous negatively accelerated one.

Batalla (158) studied the learning curves with a body maze using 100 boys and girls ranging in age from ten to thirteen years. He found curves of typical shape, boys being superior to girls. He considered the body mazes used as reliable as the stylus and finger mazes usually found in psychological laboratories. Wiley and Wiley (238) presented some further data relating to Thurstone's theoretical learning curve. Hilgard and Campbell (180) recast a body of data previously reported, showing how variations in the shape of a curve may be related to the method of plotting

the data. Critical articles of this type are useful in teaching a reader to be cautious in the interpretation of learning curves.

Miscellaneous Studies of Learning

Nine studies are difficult to classify under the preceding headings; they are treated here as a more or less unrelated group.

Jones and Yoshioka (185) conducted an experiment on the learning of a maze problem by a group of 151 children. Various factors were analyzed, such as goal impetus, drift tendency, local forward momentum, anticipatory errors, and centralizing tendencies. A transfer effect was apparent in the data of the experiment. Nelson (206) made an analytical study of the learning of 67 preschool children using a simplified problem in rational learning. The data showed that although children require more time and make more errors than adults their performance is in no important characteristic different from that of adults. These results are in accord with previous data which have already had an important effect on the nature of education in the elementary school. Eaton (169) applied the conditioned reflex technic to the learning and remembering of the names of 30 pictures. Various time intervals were used ranging from 20 to 60 seconds between the presentations. Other modifications in technic were employed such as interpolated rest and various types of mental activity between different periods. Baker (157) studied the effect of varying attitudes and conditions on distraction experiments. He used seven groups of ten subjects, each performing oral serial addition for ten periods with alternating quiet and noisy conditions. Two groups were told that distraction retarded work, two were told that it speeded work, one group that distraction had an initial retarding effect but later aided work, while two groups had uncontrolled attitudes. The expected results followed for the groups, but in individual cases previously existing attitudes complicated the results. Baker found that knowledge of the subject's own results was not as effective a motivating device as was comparison of the scores with others.

Two experiments dealt with linguistic learning. In the first of these by Briones (161), 36 university students ranging in age from seventeen to thirty-one years were used as subjects. The material included words and phrases from one of the Philippine dialects. He found no significant correlation between the number of foreign languages studied by the subjects and the ability with which they learned the particular dialect. Age favored the younger subjects although it must be kept in mind that the total group was small. Chapman and Gilbert (162) reported a study of the influence of familiarity with English words on the learning of their foreign language equivalents. College students were also used as subjects for this experiment. He found that learning took place more quickly when the equivalent English word is familiar and also that the association was more permanent in that case.

Jayne (183) made a study of the integrated versus the nonintegrated use of motion pictures in a classroom. The expected results were obtained, namely, that children gained more information from an educational film which was studied intensively as an integral part of the learning unit than when it was shown incidentally some time before the formal class study of the work began. In every respect the integrated method was shown to be superior.

Elliott (170) made a comparison of the effectiveness of learning when the material was presented visually, by means of auditory stimulus, and by a combined visual auditory process. The last method showed some superiority but the results of the experiment were not entirely consistent. Rice (219) reported his study of the relative effectiveness of extensive reading versus intensive textbook study for acquiring a knowledge of scientific facts and principles. The extensive reading method seemed to produce superior results under the conditions of the experiment.

The writer has gained the impression from this review of the literature on learning that there is a large quantity of research on basic issues which carries important implications for the learning process in school which is overlooked by writers on educational method and by those who are concerned with the organization of curriculum materials. There is need for authors of educational materials to familiarize themselves with the psychological implications of studies related to their writing. The fact that much of this type of research is published in psychological rather than educational journals calls for broader reading on the part of many school people.

CHAPTER III

Motivation, Emotional Responses, Maturation, Intelligence, and Individual Differences¹

WILLIAM CLARK TROW

Motivation

Theoretical Approaches

THE PROBLEM of motivation involves definite theory whether explicit or implicit. Illustrative of the building of a theoretical position by experimental procedure is the report by Coghill (269). Summarizing work on the correlation of structure and function in the development of behavior, he discussed the implications of the concepts of individuation and integration for the problem of motivation as it operates in connection with instinct, psychopathology, and personality growth. A symposium on the Law of Effect, participated in by Carr, Dashiell, Thorndike, and others (307), presented the viewpoints of leading workers in this field (see Chapter I).

The influence of Lewin's work is to be found in experimentation on the incompleting task by Marrow (315), in the relation of this view to the goal-gradient hypothesis by Hull (292), and in the work on the influence of barriers by Wright (381). Lewin himself expounded the importance of the relation of expectation and aspiration to success and failure as a neglected factor in motivation, and, in collaboration with Lippitt (308), described the observational procedures employed in investigating autocratically and democratically controlled child groups in which individual and group motivation were significant factors.

Drives and Incentives

Mitrano (324), using five-year-old children, experimented with secondary motivation by means of marbles which might be substituted for chips to obtain candy. He found that "foresight" appeared at this age and that habits farther from the goal were broken more easily. Persistence in preschool children under motivation of praise and competition was studied by Wolf (380) and by Ryans (345), the latter by multiple-factor analysis. Ryans found that the persistence factor bore little relation to intelligence or to perseveration. The studies of Bridges (257, 258) made with nursery school children led her to conclude that the basic emotions appearing at that age are suffering and delight, and that the human organism's first and most fundamental behavior drive is to extend and prolong its life

¹ Bibliography for this chapter begins on page 321.

and to preserve its individual integrity. A summary of particular drives and their time of appearance from birth to five years was appended and 28 references listed.

Taylor and others (362) reported that rewards increased efficiency but did not affect boredom, and Burns (263) and Forlano (278), the latter with an 89-title bibliography, that knowledge of results slightly aided performance. May and Doob (316) reported on competitive and cooperative habits, citing 220 titles; Benton (250) discovered that strongly motivated subjects did no better on a repetition of the Otis S-A than a matched group; and Abel (242) concluded, on the basis of an experiment with the finger maze, that it is the goal which stimulates learning and not its attainment, since the former creates in the individual the restlessness and energy which initiates activity, while the latter brings about quiescence and surcease from striving.

Punishment

A negative incentive has been employed in a number of experiments, notably by Anderson (246), who found that for young children using a hand dynamometer blame and failure were less efficient than praise and a knowledge of accomplishment, and by Sears (347), who concluded that in learning nonsense syllables and in card sorting, false reports of successful performance were more effective than reports of failure. In a connectionist experiment by Stephens and Baer (358) the influence of "wrong" as a punishment was not significantly different from that of "right" and other effects when the opportunity for inner repetition was reduced. Cason (267) reported that although distraction caused subjects to exert greater effort their efficiency on mental tasks was lowered.

Emotion

Physiological Approaches

It is probably safe to say that no area in the field of psychology has undergone a more complete reorganization during the past decade or two than that of the study of emotion. From the earlier subjective interest, experimentation has led to physiological and sociological investigations. Gardner (281) using the Luria technic in a free-association situation reported that critical and noncritical words were differentiated by longer reaction times, more intense pressure of the preferred hand during the latent period and following the required pressure, and by more intense deflections. Speer (354) combined the Luria technic with an introversion-extroversion questionnaire, the items of which produced "emotional" reactions, but he found no significant differences between groups of items or of subjects. Brandt (256) concluded that the manifold association test he used (a) can measure the individual's unwillingness to admit a conflict,

(b) can indicate degrees of tension generated by specific stimuli, and (c) can become a diagnostic instrument. Krause (304) checked the Luria technic with two other criteria of the presence of complexes—long reaction time (over 2.6 seconds) and failure at reproduction of the response word—and concluded that the Luria method is valid if these other criteria are also used.

Approximately a score of papers have appeared by Landis and Hunt (306) and collaborators describing the photographic procedure employed and the results obtained in the identification of the startle pattern. This familiar, primitive response is regarded as of first importance in the analysis of emotional behavior, since it is not subject to voluntary inhibition and its extent differs in different subjects, though it may be called out by other stimuli than the usual pistol shot. Relationships have been shown to facilitation, habituation, respiration, heart rate, mental abnormality, handedness, twin responses, and, in infants, to tumescence, defecation, and the Moro reflex.

Fears

The number of studies which have been made of fear reactions perhaps warrant their consideration together instead of in other connections in which they might properly be treated. Meyerson (320) worked out a detailed classification of the common nightmares, and Lomas (311) did the same for stage fright. Zapf (382) found a low but positive relation between children's fears and superstitions. Means (317), using a fear schedule of 349 stimulus words or phrases, found that only 38 percent of the college women tested indicated any knowledge of the origin of their fears and that 70 percent of those fears which were of known origin were due to personal experience. The five highest ranking fears were of snakes, cancer, death of loved ones, death by burning, and bulls. In a series of three papers Brown (261) reported that just before college examinations there is an increase in systolic blood pressure, pulse and respiratory rates, and blood sugar; some students showed glycosuria. The degree of the above changes was dependent on the difficulty and length of the examination and on the individual. Questionnaires revealed that final comprehensive examinations of seniors roused the most excitement, the peak of which occurred just before the papers were passed out.

A study of methods of overcoming children's fears led Jersild and Holmes (294) to conclude that those methods are best which "help the child to become more competent and skilful and that encourage him to undertake active dealings with the thing he fears." This plan was followed in an investigation reported by Holmes (291) and was successful in overcoming the fears of thirteen out of fourteen children who were afraid of entering a dark room.

Adjustments and Treatment

B. Johnson (296) described the emotional responses of eighteen preschool children in three ingeniously devised situations. The anger adjustments of college students were analyzed by Meltzer (318) on the basis of controlled diaries. Walton (370), investigating empathy in children by the use of a matching test involving words, lines, colors, and pictures, found that the empathic pattern was present in the kindergarten and that it exhibited a fairly uniform growth with individual differences at all age levels. Murphy (326) presented evidence for the appearance of sympathy at the nursery school level and described the motivation and development of sympathetic responses.

A personality questionnaire, administered to 1,400 adults by Willoughby (377), showed the women to be more emotional than the men and married women to be slightly more emotional than the unmarried. Stagner (356) reported the Wisconsin Scale of Personality Traits, resembling the Bernreuter, for "introversion" (Stagner-Pessin), "Persistence" (Wang), and "general emotionality" (Thurstone). A case in which emotional pressure found immediate outlet in reality regardless of consequences, perhaps due in part to a demonstrated deficiency of imagination, was reported by Reichenberg and Chidester (340) as illustrative of a probable cause of some delinquencies. Prescott (339), in an American Council publication, reviewed the literature on the relation of emotion to various aspects of the educative process. Psychotherapeutic measures were employed by Bender and Woltman (248, 249) for treating the emotional problems of children. They advocated the use of puppets, which operate through the mechanism of identification, and of plastic material as a medium for expressing aggressiveness, counteraggression, destruction, and construction through which the child may be brought to have insight into his created symbols, thereby gaining access to social reality.

Keister and Updegraff (302) presented 82 preschool children with one problem-solving and one weight-lifting situation resulting in failure. For those children who showed immature responses (crying, sulking, destructive behavior) a training program was instituted consisting of simple tasks becoming progressively more difficult, the consequence of which was that the immature behavior was eliminated and the children tried longer and manifested more interest in solving a problem for themselves without help from an adult.

Maturation

Growth

Growth studies from California were reported by Stolz and others (359), from Iowa by Boynton (253) and Jersild (295), from Harvard by West (373), and from Michigan by Olson (331). Abernethy (243) revealed the unsatisfactory nature of many prevailing technics for dealing with growth data. Hardy and Hoefer (286) made a report of a study of the influence

of health education on the growth and development of school children. Freeman (280) found that growth curves from a composite mental test proceeded with little decline from eight to sixteen years and continued at least to age twenty, with wide individual variations.

With the expansion of the psychological program in nursery schools and kindergartens has come a mass of research data on the first years of life. Meredith and Knott (319) reported changes in body proportions during this period; Peatman and Higgons (333) and Davenport and Drager (270) furnished growth norms. Campbell and Breckenridge (266) presented a 319-page document on the growth of one child from twenty months to eight and one-half years of age, and Dennis (272) a 64-title bibliography of baby biographies. Much valuable work from the Yale laboratories under the direction of Gesell (284) on growth of sequential patterning has been reported, and correlational data on infant development by Bayley and Jones (247). An observational study made by Swan (361) of facial motility sought to discover relationships to body type, vocalization, etc.

The language of the child has received considerable attention in recent years. Olson and Koetzle (330) found that nursery school and kindergarten children in free play periods spoke on the average 16.5 words a minute—at a rate of 186 words while speaking—and some talked seven times as much as others. Correlations with other single factors were ambiguous. On the basis of the study of the development of language of two boys Low (312) criticized the use of the length of sentence, or of any other single criterion, as an all-round measure of language development in the infant, a condition which would be taken into account by Williams (376) in the construction of a language scale. Singing and rhythmic development were studied by Seltzer (348), and domination and integration in social behavior by Anderson (245).

Anderson (374) gave 415 pages to the subject of home and parent influence; Ulton (368) found an expected positive relationship between economic level, intelligent parent influence, and social and emotional integration; and Hattwick and Stowell (288) concluded that children who are "babied" or pushed by their parents have many more social difficulties and poorer work habits than children from well-adjusted homes. Childhood personality development was studied by M. C. Jones and Burks (299), and emotional development by Blatz, Chant, and Salter (251). Boynton (254) reported a survey of the wishes of 1,569 elementary-school children.

Mott (325) studied the relation of children's drawings to concept development and child personality; Kerr (303) modified the procedure by having his subjects draw a house, from which drawings an age scale was attempted, and he compared the results for normal and defective children. Russell (344) concluded from an experiment with piles of different-sized blocks that out of a concept of "manyness" the seven-year-old has differentiated that of "most" and "more," but not "same" and "equal," hence it is improbable that first- and second-graders are mature enough to "master com-

pletely and understand isolated addition and subtraction facts." Using the term reasoning to mean the combining of two isolated experiences in order to reach a goal, Maier (314) observed that this ability was rarely developed in children below six years of age, with wide individual differences.

Adolescence

Adolescent development seems in general to be reported with more clinical and less quantitative evidence than that of earlier stages. Hardy (287) concluded that relatively frequent experience in the illness situation during childhood was not a handicap to personality development. Shuttleworth (349) has compiled an interesting graphic and pictorial atlas of the adolescent period based on a number of investigations. The California adolescent growth study was reported by H. E. Jones (298) and a two-year study of 200 boys by Dimock (273).

The role of parents in the development of emotional instability was indicated by Stagner (355) who used personality inventories and autobiographies, and conflicts with mothers were reported by Block (252). In a followup study of problem children by Kanner (301) it was found that best results were obtained with the largest number of the following good environmental conditions: sound ancestry, tolerable home conditions and good family, and school and communal cooperation and facilities.

Youth and sex were studied by Bromley and Britten (260) and by Willoughby (378). Iovetz-Tereschenko (293) presented a developmental picture of the "crush," called friendship-love, from diary material. Two monographs by Shuttleworth (350, 351), appearing as a part of the Harvard Growth Study, compared sexual maturation and a number of standard physiological and X-ray measures of 315 cases.

Intelligence

Factor Analysis of Mental Ability

The use of factor analysis by Thorndike and Stein (363, 364) led to the conclusion that the George Washington social intelligence test may tap slightly some unique field of ability, but that it measures primarily the ability to understand and work with words—which bulks so large in all abstract intelligence tests. Thurstone (365, 366) in fifteen hours of testing of 240 university students found twelve factors by analysis, the seven most fundamental being (a) spatial or visual (visualizing), (b) perception of visual detail (perceptual speed), (c) numerical (number facility), (d) verbal—logic (reasoning), (e) verbal—words (word fluency), (f) memory, and (g) induction. Anastasi (244) concluded from a study of 200 sixth-grade children that factor patterns are altered with training and that they differ from one population to another. An extensive bibliography was cited.

The Constancy of the IQ

By far the most active area in the investigation of intelligence is that of the rate of mental growth in relation to age. Lincoln (310) in the Harvard Growth Study reported a median IQ change of seven points on a repetition of the Stanford-Binet on 1,200 children. Similar findings in clinic retests by O'Neill (332) led him to conclude that increase, decrease, and fluctuation in IQ are dependent on a combination of causes, including physical and psychological abnormalities, age, and test defects. Test results over a ten-year period, analyzed by Freeman and Flory (279), revealed individual irregularities, though the duller children exhibited an almost constant rate of growth whereas the brighter children showed an acceleration of rate in later childhood which tended to slow down in middle and later adolescence. Wellman (372) reported correlations ranging from .40 to .51 between preschool-primary Binet IQ and high-school intelligence test percentiles, and Cattell (268) found that the median differences between one tester's results and those of two others, testing the same children within one year, were +9.3 and -3.7 points. Thus some of the alleged changes in IQ turn out to be differences in testing.

Comparisons found to be unfavorable to the intelligence of underprivileged children when matched with unselected groups were made by a number of investigators, though Schott (346) found that the average change after placement in foster homes was about the same as variabilities reported from investigations unconcerned with environmental improvements affecting the retest.

Nursery school experience was found to increase the IQ, according to Peterson (334), though a "rich, vital school curriculum" through the fourth grade, Lamson (305) discovered, had no such effect. Poull (337), however, found that 41 malnourished children raised their scores 10 IQ points after a period of nutritional care as compared with a zero gain for a matched but well-fed group. Hawk (289) reported IQ gains of as much as 40 points after six months to a year of speech training. Such studies reveal the need for more adequate control in the form of growth records of the cases reported. Without these, one knows little more than he knew before, namely, that environment does influence psychometric intelligence.

Special Groups

The intelligence of special groups of persons differentiated on the basis of various hereditary, psychological, and social factors was extensively studied. Byrns and Henmon (265) obtained group intelligence test scores for over one hundred thousand high-school seniors. When classified according to the six main occupational groups of their fathers, the median differences between groups were statistically reliable, though the intelligence differences within the groups were greater than the differences between

groups. Stalnaker and Woellner (357) found no significant intelligence differences between college sophomores seeking and not seeking employment; and extension students, according to Sorenson (353), were likewise approximately equal in measured intelligence to regular university students. Social competence measured by the Vineland social maturity scale was elaborated by Doll and McKay (274, 275), particularly as it relates to the feeble-minded, who were differentiated from the subnormal by Bradway (255). A group of transient boys showed backwardness, but considerable all-round improvement after a six-months' vocational course, as reported by Smeltzer and Adams (352).

Intelligence and Education

Olander and Walker (329) concluded that the combined judgments of four teachers made as dependable an intelligence rating as a single group test, though Gibbons (285) discovered that high IQ's tended to be underestimated and low IQ's overestimated by teachers. Wile and Davis (375) argued from data on 300 children that basal age, representing the level of integrated intellectual development, is a more important guide than mental age in the prognosis of school efficiency.

According to Pratt (338) higher scores were made by those who employed algebraic procedures than by those who used arithmetical procedures exclusively, and Ross (342) found that the Seashore tests of musical talent correlated low positively with Terman group tests in 1,541 school pupils, but higher with achievement in reading and arithmetic. Tiebout and Meier (367) found similar low positive correlations between intelligence test scores and ratings of artistic ability, though exceptional ability in music or art was regularly accompanied by superior intelligence.

Individual Differences

Nature and Nurture

Burks (262), following elaborate statistical technics, concluded that the relative contributions are, nature 75 percent and nurture 25 ± 8 percent, to group differences in intelligence. Stone and Barker (360) found post-menarcheal girls more mature than premenarcheal girls of the same chronological age in interest-attitude and developmental age, though not differentiated in Otis intelligence and Bernreuter personality. Newman, Freeman, and Holzinger (327) concluded from their careful study of 50 pairs of identical twins reared together (with fraternal twin controls) and 19 pairs reared apart, that environment affects physical traits least, ability and achievement scores more, and personality and temperament most, though there is yet no general solution of the major problem or of the multiplicity of minor problems which the investigation opened up. Other studies of twins were reported by Rosanoff, Handy, and Plesset (341), who suggested

that the hereditary factor in feeble-mindedness is less important than is usually supposed.

Psychological and Social Differences

A review of 125 titles relating to gifted children was reported by Noonan and Norris (328). Miller (322), who compared the records of 83 exceptionally able college seniors with those of 558 others, found the gifted group better adjusted, as did also Miles and Wolfe (321), who concluded that separate ratings of the 50 geniuses reported in Vol. II of the *Genetic Studies of Genius* for physical and mental health during their childhood were about the average for unselected children.

Relationships between mathematical ability, reasoning, and scholarship were reported by Washburn (371) and between good and poor spellers by Russell (343). Similarly, differences in young children's reputations as shown by a "Guess Who" questionnaire were reported by MacFarlane, Honzik, and Davis (313), and variations of normal first-grade children in intelligence and achievement by Wilson and Flemming (379).

Interesting and valuable data were collected on various kinds of physical and economic deviates: by Piness, Miller, and Sullivan (335) on allergics, who were found to be normally distributed mentally; and by Dearborn and Rothney (271) on unemployed youth, who could not be distinguished from the employed on the score or more of items used, except in ethnic origins, methods of securing employment, paid work during school, and education beyond high school. Children from broken homes (369) and in a delinquency area (309) showed retardation and lower IQ and socio-economic status, though with large overlapping.

Studies of educational sex differences by Jordan (300) and G. R. Johnson (297) showed test results to be virtually indistinguishable, but educational progress to be fraught with hazards for boys in women-manned schools. Even vigorousness of play activities of preschool boys and girls revealed no significant differences (277).

Racial and Linguistic Differences

A study of the intelligence of several different Wisconsin nationalities was reported by Byrns (264), and of European nationality differences in musical ability by Dykema (276). Brill (259) summarized 23 comparative studies of the Jews and non-Jews. Conclusions as to the effect of bilingualism seem to be somewhat equivocal. Mitchell (323), using English and Spanish directions for the Otis nonverbal intelligence scale, discovered the bilinguals to be at a disadvantage. Garth and Smith (283) likewise found Indian children 10 to 14 IQ points higher on nonlanguage tests than on verbal tests, and Garth, Elson, and Morton (282) found Mexican children equal to American children on a nonlanguage intelligence test (Pintner) but inferior on a verbal intelligence (Otis Classification) test. But Pintner and

Arsenian (336), working with Brooklyn Jewish children, and Hill (290) with Italian children, discovered no relation between bilingualism and verbal intelligence.

Conclusion

Research on factors affecting learning gives added knowledge of the nature of children and of the influence of different kinds of environment. The most promising lines of future development according to the opinion of the present writer are to be found in: (a) further inquiry by the factor analysis technic, (b) a replacement of cross-sectional by longitudinal (genetic) studies viewing the organism as a whole, (c) more detailed investigations of pupil interests and attitudes, and (d) a much more complete knowledge of the relation of the behavior of individuals to the group patterns of which the children are a part.

CHAPTER IV

General Methods of Teaching¹

ANGELA M. BROENING

THE SMALL AMOUNT of research here reported appears to indicate a change in the kind of research being conducted. There is an apparent trend away from studies of "general" methods. For the most part research in the field of methods is closely identified with specific subjectmatter and is reported in the numbers of the *Review* devoted to "Psychology and Methods in the High School and College" and "Special Methods and Psychology of the Elementary-School Subjects." There is also a tendency among contributors to write an informal narrative or journalistic exposition of a personal experience in teaching rather than present a straightforward account of scientific technic. Perhaps the highly formal measurement movement and statistical analysis have moved from the center of the stage, allowing the teacher and the pupils to appear again in the spotlight. It may be that when research on methods so often proved only what experience had already taught, teachers took heart and began to report in periodicals narrative or expository accounts of their "experiences."

In any case, the professional literature of the past three years indicates that elementary- and secondary-school teachers and professors of education are still discussing methods of teaching. Such topics as remedial, diagnostic, or test-determined teaching, lecture, recitation, learning by wholes versus learning by parts, memorizing by reading versus recitation, inductive versus deductive learning, drill, appreciation, laboratory, project, problem, socialized recitation, unit plan, contract plan, case method, committee, conference plan, discussion, panel discussion, review, supervised, directed, or guided study, group plan, visual aids, auditory aids, scientific aids to teaching, photoplay, radio, constructive activities, activity program, and integration have appeared and reappeared in the periodicals, but usually only as whole-hearted accounts of enthusiastic teachers who have had an "experience" worth talking about. While such writing cannot be regarded as research, it may play a helpful role in scientific progress. Thus Gates (419: 90) stated: "For specialists in scientific study to set themselves apart from the course of critical and creative theoretical inquiry would be as fatal a mistake as for the theorists to disregard the results of experimentation. Broader views, and more searching criticisms of both investigation and generalization, as well as more and better research, are required to enable the scientific method to realize its high promise."

There follows a review of those investigations which were concerned with what may be classified as "general methods" either because the procedure

¹ Bibliography for this chapter begins on page 327.

pertains to several subjectmatter fields or because it is embraced by the term as commonly used by educators.

Comparison of General Methods

Monroe and Marks (418) summarized studies on the lecture, recitation, laboratory, project, socialized recitation, and Morrison Plan methods of teaching. Only studies in which the pattern of instruction was the experimental factor were evaluated. This research, scattered over many years, was found fragmentary both as to grade levels and subjectmatter fields, and unsatisfactorily controlled in respect to nonexperimental factors. As a whole, the research showed the "traditional" method inferior to the project and laboratory methods. The evidence, though not conclusive, seemed to support the inference that a method of teaching which recognizes individual differences and emphasizes student responsibility is more likely to be effective than one which does not take these factors into consideration. The reviewers concluded that probably no method makes it impossible for a resourceful teacher to provide for individual differences and to emphasize student responsibility.

An attempt to discover what is good teaching was made by Copper (388) through a questionnaire submitted to his college students. Forty-six of the 100 replies listed "arousing interest on the part of the learner" as the essential of good teaching. This opinion, he found, was supported by descriptions of five great teachers of the ages.

Students were consulted also by Ford (397) who used a questionnaire to check his students' preference for the four methods by which he taught them: (a) lecture with blackboard outline, (b) lecture with no blackboard outline, (c) no lecture with discussion and recitation only, and (d) lecture, blackboard outline, and discussion. Ninety-five percent of his students believed they learned more by the fourth method; 87 percent felt they learned more if they took notes. Mimeographed outlines and questions were regarded as being helpful by 87 percent of the students responding. Other student comments were: (a) Student-directed endeavors such as reports, projects, and demonstrations were usually a waste of time. (b) Students worked harder if they had short daily and weekly examinations rather than longer six-week examinations. (c) Unit assignments were better than page assignments. (d) Informal lectures with opportunity for questions were more interesting than formal procedures. (e) Better work was thought to be accomplished by working alone in the laboratory than by working with a partner. (f) The practical side of chemistry, its applications, usefulness, and relation to daily life did not receive sufficient emphasis.

Perrigo (423) used a questionnaire to discover which method of teaching his 85 students believed had brought them the best results. Four classes (two in history and two in sociology) were taught as follows: (a) a unit of lecture, one of lecture and discussion, and one of student-directed group

work; (b) syllabi, unit assignments, and daily assignments; (c) a period in which outside reading was reported and another in which no check-up was made; (d) student reports at the conclusion of each unit; (e) unit examinations, some essay, some new-type, and some a combination of the two; (f) in two classes the examination was used as a teaching device—one given at the conclusion of a unit was intended to reveal the weaknesses that needed to be remedied during succeeding review sessions in preparation for a second examination a week later. He found that "student opinion in general correlated with conclusions often reached elsewhere after extensive objective investigation."

As a result of experiments conducted, Forlano (398) stated that in the case of school children in the fifth and sixth grades working under ordinary classroom conditions and with methods and material common to the school, learning by recitation is clearly superior to learning by reading. He also ascertained whether giving the learner knowledge of results immediately after a word or arithmetical fact has been studied is more beneficial to learning than when knowledge of progress is delayed for that word or fact. The results of his experiments showed in addition that there is a tendency for learning during which the learner ostensibly receives immediate knowledge of results to be less efficient than learning in which knowledge of results is delayed. It should be said that this superiority of the "delayed knowledge of results" method did not always approach statistical certainty. Other findings were these: (a) Learning which is accomplished under a promise of a monetary reward was more efficient than learning for which no reward was promised. This superiority, however, was not always statistically significant. (b) Learning accomplished under the condition of an actual money reward was more efficient than learning for which no reward was given. (c) The potency of a promised reward was as great as and in some cases slightly greater than an actual reward.

A controlled-group investigation of the relative instructional efficiencies of the lecture and discussion methods was conducted by Gerberich and Warner (402). Only small and unreliable differences in final achievement for heterogeneous initially-equated groups were found for either semester of their experiment in a university course in American national government. However, when the groups were divided into above-average and below-average sections, the findings for both years indicated superiority for the above-average students in the lecture sections and for the below-average students in the discussion sections. Although these differences were in no case reliable, the agreement in the direction of the differences found for the two years suggested the possibility that more complete differentiation of technics or more rigid adherence to the formal lecture and group discussion methods might well have brought out the reliability of the differences obtained. A comparison of matched groups on a radicalism-conservatism scale of attitudes for the second-year investigation showed strong probability of a stable difference favoring a more liberal final attitude on

the part of the lecture students. The authors concluded that a lecture technic was superior as a means of liberalizing the viewpoint of students. It also was superior to the discussion technic in bringing about desirable informational outcomes for the above-average students. Below-average students profited more in tangible outcomes of the courses under the discussion method of teaching.

Pistor (427) attempted to use observational technics in evaluating (a) practice or drill, (b) conference, (c) problem-solving, (d) creative activities, (e) directed study, and (f) informal before-school activities. Standardized achievement tests were also administered during the two-year experiment. The observational method has the advantage of measuring the pupil as he functions in the classroom but it is time-consuming and costly.

The Unit (or Contract) Plan

Concern for individual differences of pupils has fostered the widespread use of the unit (sometimes entitled contract) plan. Peters (425) discovered that the probability is a little greater that a particular pupil will do better under the contract than under the recitation method and that the probability is still greater that the average attainment of a class taught by the former method will be higher than if taught by the latter. Moreover, from 17 controlled experiments involving 104 measured group contrasts, centered on the same hypothesis, he showed that reliability and validity are vastly increased by massing experiments. This investigation is, therefore, significant for its information both on methods of teaching and on methods of massing experimental data.

Douglass and Pederson (392) compared the unit plan and the study-recitation method, holding as the essential variable factor the amount and allotment of time devoted to supervised study. In the unit plan, a preview was followed by supervised study for one hour a day on four consecutive days and a full hour discussion on the fifth day. In the study-recitation method the assignment was followed by thirty minutes of study and twenty-seven minutes of discussion daily on five consecutive days. The experiment ran for one hundred and six actual teaching days. From the data collected, the experimenters concluded (a) that the unit plan described, in the hands of well-trained teachers familiar with the plan, is likely to yield results slightly superior to those obtained by a study-recitation plan of supervised study—at least as judged by the results of objective tests and teachers' marks in classes in which objective tests are employed; (b) that the unit plan in question is probably better suited for bright than for dull pupils; and (c) that teachers cannot be relied on to predict accurately the relative effectiveness of two teaching procedures so nearly equivalent as are the two plans of supervised study employed in this investigation.

Supervised-Directed-Guided Study

"What has happened to supervised study?" was discovered by Brownell (385) through a survey of periodical literature, informal conferences with educators, and inspection of research studies. He concluded that the term is passing from professional literature; that many communities, after brief try-outs, found little reason to retain supervised study, and that research has not yielded the expected support for supervised study as defined in that investigation. "Guidance of learning" is the current concept which has absorbed the supervised study idea.

An experiment was conducted by Di Napoli (391) to test the validity of the single claim that compulsory homework results in improved academic accomplishment. The evidence in this experiment revealed the fallacy of this claim, so far as the 1,200 pupils in the six New York elementary schools were concerned. In order to preserve the natural situation, the factors in the teaching situation, namely, the teacher, the methods of instruction, the textbooks, and the school environment, were not altered. Achievement tests and interest inventories were administered at the beginning and at the end of the spring term. The experimenter concluded from his findings that compulsory homework in the fifth grade and voluntary homework in the seventh grade favor achievement as measured by a battery of standardized tests. The differences were not highly reliable.

Mathews and Toepfer (415) compared the study habits of pupils and generally recognized principles of effective study. They analyzed widely used manuals on study methods to determine principles considered important, investigated the study habits of a group of children in a six-year high school in a rural community which employed superior teachers, and compared the principles and the practices. The data disclosed that many pupils did not know the best principles and procedures for effective study, that a mere knowledge of these principles was insufficient to insure efficiency in study and that high-school principals and teachers needed to provide rich opportunities for actual practice in efficient study methods under skillful supervision of teachers who are themselves competent students.

A self-analysis blank on study habits was submitted by Rosenstengel and Dixon (431) to 567 junior high-school and 600 senior high-school pupils. Sixty-one percent of the junior high-school pupils had regular schedules for work; 39 did not. Fifty-one percent of the senior high-school pupils had, and 49 percent did not have, regular work schedules. Less than one-fifth of the pupils wrote down the assignment. Ninety-eight percent reported they "worry" when they go to class unprepared. The investigators concluded that there is a definite need of teaching junior and senior high-school pupils the use of general study habits.

How to study and how long to study, problems raised in the investigations reviewed above, are related to the difficulty of the material being studied. Jensen and Schrodtt (407) found that children at the sixth-grade

level learn about twice as much per unit of time from study material well within their range of comprehension as from the more difficult treatments they are frequently expected to master.

Test-Determined Teaching

Eurich (396) concluded from a five-year study at the University of Minnesota that attention directed toward better examinations involves consideration of the effectiveness of teaching and of the curriculum. Broening (384) found that "tests can teach" any high-school subject if diagnostically coded, machine-marked answer sheets are used with teacher-made valid and reliable tests of the skills and knowledge which are outcomes of the course.

Laboratory, Lecture, and Demonstration Methods

The laboratory method has become a "general" method since teachers' awareness of its possibility in providing for individual differences in interests, in learning rate, and in levels of achievement has extended its use to English and the social sciences. While the literature contains accounts of "experiences" with this method in these fields, the teachers of science are investigating whether demonstrations and lectures can replace, in whole or in part, individual laboratory work. Goldstein (404) attempted to find out whether allowing students to do laboratory work is a better way for them to develop laboratory resourcefulness than is teacher demonstration of the same material. Within the clearly stated limits of his experimental setup, the experimenter discovered that gaining experience by laboratory work seemed to be a better means of developing resourcefulness than gaining experience by watching demonstrations. Investigation of the relationship between resourcefulness and other factors, such as intelligence, achievement, maturity, and experience, disclosed that experience is the basis of all resourcefulness.

Reviewing historically the development of the laboratory technic of teaching science, Knox (409) emphasized these findings from available research: (a) demonstration work gives better results with oral instruction, (b) laboratory work gives better results with written instructions, and (c) laboratory instruction is superior to the demonstration method. Using empirical evidence accumulated during his twenty years of teaching science, Barger (383) concluded that the "class participation method" is superior to individual laboratory experiments in high-school chemistry. He defined the more effective method as a combination of the individual-laboratory and the lecture-demonstration methods. The advantages of the class-participation method Barger summarizes as these: the pupils prefer to see and to hear each other rather than the instructor doing something; they give better attention to the procedure; it permits an exercise to be given in either laboratory or classroom; and the pupils ask more questions. The advantages over the individual-laboratory method are that the exercise is

performed more rapidly and effectively; there is no loafing or careless handling of apparatus; better attention is given by the class as a whole; better outside preparation is made; it encourages outside reading; it demands the acquisition of the desired vocabulary sooner; it develops the ability of the pupils to perform and talk before the class; and insures that all pupils will understand all parts of the exercise.

Krenerick (410) defended the laboratory method of teaching science and showed how the laboratory can be made the nucleus of the entire course. Elder (395) surveyed the opinion of 100 chemistry teachers and industrial chemists and projected experiments to discover the relative merits of the lecture-demonstration and the laboratory method. Fuller (400) concluded that demonstrations have their place in high-school science but that scores of experiments, not suitable for the demonstration table, are best tried in the individual laboratory. Freeman (399) investigated the value of written reports in demonstrational teaching in psychology classes. Demonstrations were witnessed (a) without notetaking, (b) with elaborate notetaking, and (c) with simplified notetaking. After improving the demonstrations, he found students who recorded relevant ideas gained more than those who read the manual before the demonstration but took no notes. Experimental investigations of the measurable outcomes of laboratory work in science were reviewed by Duel (394). When he noted that the earlier studies consistently favored the laboratory method while all but one of the more recent studies favored the demonstration method, he called attention to the fact that nearly all of the investigators had based their comparisons upon subject-matter tests and had made little or no attempt to measure other informational outcomes.

Visual-Auditory Aids

Excursions, pictures, models, specimens, maps, charts—all these preceded the motion picture and sound films now used in education. Human voices recorded on phonograph records came before radios. Television is a new aid soon to be available. These sources of enriched teaching, unfortunately, are discussed in the literature more as "experiences" than as "experiments." Lemler (412) attempted to gather the cumulative experience of teachers with reference to 392 films which they had used. One hundred and eighty-six were rated excellent; 126, good; 55, fair; and 29, poor. Teachers indicated that available teaching films not only included extraneous materials but omitted other materials of importance and significance. Prothero (428) surveyed visual aids at work. He found that the visual aid most widely used is photographic and printed material. Working models made of wood, metal, cloth, or paper are widely utilized in mathematics, science, and art departments. Lantern slides, more often commercial products than pupil-made, were being used in the social studies, science, and art departments. Dramatic materials including costumes and scenery

were not made use of in as many departments as is desirable. Specimen collections were employed more often in science departments than in any others. Motion pictures were used in science, physical education, and social studies. Sound films, even pupil-made films were occasionally utilized; microscopic slides, in the science, art, and home economics departments. Prothero concluded that even more effective use could be made of visual aids.

The integration of motion pictures with other objective teaching aids will, Ramsey (429) claimed, overcome a lack of firsthand experiences. A similar conclusion was reached by Merton (417). An "electric teacher" (411) to help pupils memorize has been invented.

Schoenhof (432) reported how a continuous visual program from excursion to pupil constructive and creative activities vitalized learning. A 400-foot film was made to preserve glimpses of the pupils at work, and an illustrated story, published by the children themselves, recorded evidence of dynamic learning. Dale (390), through comparison of final with pre-test results and utilization of teachers' comments, secured evidence that his plan of demonstrations had launched the teaching of motion picture appreciation in 45 cities. Evidence is plentiful that teachers and administrators (430) are using the radio, but experimentally controlled studies have not been reported in the literature reviewed.

Activity and Integrated Programs

Activity and/or integration seem to require newer types of measurement in order to appraise the outcomes claimed by their proponents. Melvin (416) found flexibility and spontaneity lacking in "subjectmatter controlled school" and spontaneous activity and learning in situations in which only the organization and order necessary to economical learning were present. Orr and Anderson (422) reported evidences of superiority of their integrated teacher-training program over their methods previously used. The gains were in the better attitudes of the student teachers and of the high-school pupils taught. Geyer (403) surveyed the published results of activity instruction and found a preponderance of evidence indicating the superiority of this method even for traditional outcomes. Tate (434) compared the project method with any other method the teacher was using in a group equivalent to the one in which he was using the project method. Three out of four tests showed superior results for the nonproject children. Topical tests given each week revealed that project teaching was fairly effective in producing achievement but ineffective in causing retention of achievement. A carefully projected six-year research investigation of "activity" versus "traditional" methods has been launched in 70 New York schools of about 50,000 pupils. The preliminary report by McCall and Loftus (413) has been followed by others dealing with special phases of the study.

CHAPTER V

Supervision¹

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DURING the three-year period from January 1936 to January 1939, the *Education Index* classified 177 articles under the heading of supervision. In addition to those listed in the *Education Index*, another 100 articles have been published. Among these nearly 300 articles 23 can be considered as reports of research. The questionnaire method, in most cases, was used to collect data.

Supervisory Trends

Peterson (452) analyzed the articles on supervision which had appeared in a number of the leading educational magazines during the 30-year period from 1904 to 1934. The summary of her findings is given in Table I.

Table I.—Number of Articles on Each Phase of Supervision, by Decades

Phase	1904-14	1914-24	1924-34	Total
Teacher training.....	4	42	34	80
Organization.....	1	13	21	35
Attitudes toward supervision.....	0	7	19	26
Supervisory traits.....	1	9	8	18
Measuring teaching and supervisory efficiency.....		24	18	42
Supervisory policies.....		19	55	74
Supervisory technics and devices.....		8	16	24
Supervisory duties.....		12	4	16
Miscellaneous.....		10	13	23
Total.....	6	144	188	338

She concluded that (a) "there has been more interest in general supervision during the last decade (1924-34) than in the two previous decades"; (b) "during the last decade there has been less mention of standard tests and self-rating skills both as a means of teacher training and as a means of measuring teaching efficiency"; (c) "study continues to be the most positive method of improving the efficiency of teachers or of increasing professional interest"; (d) "during the last decade there has been more effort to work out various technics or devices for measuring the efficiency of teaching"; (e) "during the five years (1929-34) there has been more attention given to the economical aspects of supervision"; and (f) "from

¹ Bibliography for this chapter begins on page 329.

1924 to 1934 a critical attitude toward supervision had developed," and "during this same period increased attention was given to measuring the efficiency of supervision."

According to a report for the year 1936-37 (454) the number of supervisors, directors, and assistant directors of instruction had increased over the school year 1934-35. Data were secured from 1,895 cities of more than 2,500 in population. There were 1,406 directors and supervisors of music, 1,022 directors and supervisors of physical education. The salaries of directors and supervisors for most of the fields showed some increase over the salaries paid in 1934-35.

Jessen (446) sent a questionnaire to 329 cities with populations over 30,000 according to the 1930 census. Replies were received from 231. Ninety of these 231 cities had 522 special subject supervisors or directors. The numbers of positions occupied in the various fields were as follows: English, 31; social science, 21; science, 31; mathematics, 23; foreign languages, 29; art, 57; music, 81; physical education, 64; health, 21; vocational education, 18; commercial work, 27; industrial arts, 50; home economics, 57; and others, 12. Briscoe (440) attempted to discover the supervisory load which an individual should carry. He reported that in the states where the supervisory load was best adjusted, the median load was approximately 40 teachers with a quartile deviation of 10. School districts employing fewer than 50 teachers did not use economically the supervisory services of the superintendent, if he had no assistance. Too much of the superintendent's time was used in teaching and in administrative details that should have been done by secretarial help.

Supervision of Student Teachers

More studies have been made in the field of student-teacher training than in any other aspect of supervision. Hildreth (445) asked students to list important knowledges, skills, and technics which their experience showed they needed. The 14 most important of these follow: (a) should have a mastery of the subjectmatter to be taught; (b) should know how to teach children, not subjects; (c) should know how to construct lesson plans; (d) should have a knowledge of the subjects of all grades; (e) should know how to gain and hold interest of pupils; (f) should know how to test achievement; (g) should know how to be a teacher, not a boss; (h) should have greater opportunity to know children in the classroom; (i) need more knowledge of child psychology; (j) should have some training in public speaking; (k) need a larger cultural background; (l) should know how to cope with individual difficulty; (m) should understand student-teacher-supervisor relationship; and (n) should have a knowledge of the whole school organization. Hildreth also asked supervisors to state what knowledges and potentialities student teachers should have before beginning their student teaching. The 12 items listed as most important by the super-

visors follow: (a) a real mastery of the subject to be taught; (b) an exemplary personal life; (c) dependability in all relationships in every way; (d) a working knowledge of child psychology; (e) a course in special methods of work attempted; (f) a genuine love of children; (g) initiative originality; (h) a working philosophy of education; (i) training in voice control and public speaking; (j) a real interest in teaching; (k) realization of a need for planning; and (l) good taste in personal appearance.

Stanforth (456) asked 50 superintendents and general and special supervisors to list the specific traits and abilities which they expected beginning teachers to bring into their work as a result of their course in student teaching. Fifteen of the items in the order of their importance follow: (a) a broader vision of the possibilities of teaching; (b) an enthusiasm for schoolwork; (c) initiative, resourcefulness, and originality; (d) an optimistic outlook toward teaching; (e) a willingness to work and a knowledge of how to work with people; (f) the habits of neatness, accuracy, fairness, and firmness; (g) cultured and refined manners accompanied by high moral sense; (h) the habit of promptness; (i) the ability to analyze and discover own weak points; (j) the ability to control one's voice, posture, movements, and mannerisms; (k) a love for and patience with children; (l) a knowledge of lesson plans; (m) an understanding of school organization and purposes for which the school exists; (n) ability to control and regulate the mechanics of a classroom; and (o) skill in marking and grading papers.

Mooney (449) made a diagnosis of the supervisory activities carried on with student teachers through group and individual conferences, demonstration teaching, and supervisory observation. The information was collected by use of a questionnaire. Usable checklists were received from 208 supervisors and 392 student teachers. The checklists included concepts underlying certain practices that influence the effectiveness of supervisory activities and specific activities used by supervisors in their work of helping student teachers. Among the most important activities of the supervisor were: helping student teachers to establish desired relationships with pupils, guiding student teachers in planning for pupil participation and classroom activities, showing student teachers how to economize their own and pupils' time and energy in classroom management, stressing the importance of the proper care of the classroom, and guiding student teachers in the collection of materials of instruction. Among the supervisory activities considered very difficult by most supervisors were: instructing student teachers in applying corrective treatment to problem cases, assisting student teachers to develop independent study habits in pupils, directing student teachers in assigning work to meet pupils' individual needs and abilities, helping student teachers set up aims and purposes cooperatively with the pupil group.

Rugen (453) sought to find the effectiveness of supervisory procedures used with student teachers. Graduates of classes of 1931-35, inclusive, were

asked to rate the effectiveness of the procedures which had been employed while they were student teachers. A five-page rating scale was returned by 44 graduates, 95 percent of whom were teaching or had taught physical education. Experience in teaching ranged from a few months to five years. The rating scale provided for the evaluation of planning procedures, evaluation procedures, conferences, demonstration teaching and observation, workbooks, teaching, and supervision. In general, the replies indicated that the graduates thought the activities were "very valuable," "valuable," or "helpful." Relatively few rated the activities as "of little value," or "no value."

Strebel (457) studied the professional qualifications of the supervisors in teacher-training institutions. He found that 24 percent of the supervisors held a bachelor's degree, 45 percent held a master's degree, and 32 percent held a doctor's degree. He further found that 36 percent of the supervisors were responsible for the supervision of two or more subjectmatter fields and that a relatively large number of these institutions not only supervised the students but also had the responsibility for general supervision of the training schools. Ninety-three percent of the supervisors in the institutions reporting had control over the curriculums in these schools but had no control over the selection of textbooks used.

King (448) sent a questionnaire to 104 teacher-training institutions. Ninety-one responses were received. The replies came from 51 publicly supported colleges and universities, 13 publicly supported teachers colleges, and 27 private colleges and universities. He found that two-thirds of the institutions required from 16 to 21 semester hours in education, that educational psychology and practice teaching were required by all but two or three of the institutions, that practice teaching received on the average of 4.6 semester hours, that the average time given to observation was 33 clock hours, that the average time given to practice teaching was 43 clock hours, and that there is a tendency for the teacher-training institutions to move to a five-year program.

Supervising Teachers in Service

Whitney (459) reported a study which showed the trend in methods of motivating the growth of teachers both in small school systems and large school systems. In general he found the method quite similar. The rank order of the superintendents' judgments on effective methods used to promote the growth of teachers in service is given in Table II.

Armstrong (438) collected further information regarding the ways in which supervisors were helpful to teachers. The five ways of being most helpful were: (a) discovering and encouraging particular strengths in method or in the personality of the teacher, (b) organizing the school so as to prevent distractions, (c) developing with teachers the objectives of each course, (d) helping the teacher set standards of achievement for each class, and (e) helping the teacher keep abreast of late educational move-

Table II.—Rank Order of Superintendents' Judgments on Effective Methods Used To Promote the Growth of Teachers in Service

Small systems	Large systems
1	2
1. General teachers meetings at regular intervals	1. Measuring the results of teaching with remedial suggestions
2. Classroom visitation by superior officer	2. Reading professional literature
3. Personal conferences	3. Personal conferences
4. Group conferences on specific problems	4. Group conferences on specific problems
5. Measuring the results of teaching with remedial suggestions	5. Supervision by general or special supervisor
6. Reading professional literature	6. Visiting other teachers
7. Visiting other teachers	7. Classroom visitation by superior officer
8. Participation in curriculum-making	8. Participation in curriculum-making
9. Establishing happy community relationships	9. Experimental study of teaching problems
10. Teacher participation in administration	10. General teachers meetings at regular intervals

ments. The ways in which the teachers thought the supervisors were least helpful were: (a) trying to help teachers develop a bibliography for the course, (b) trying to make it possible for teachers to know about all professional organizations, (c) helping to make known to teachers the source of free material on teaching, (d) helping teachers build up a working philosophy of education, and (e) trying to acquaint teachers with the latest developments in psychology.

Shannon (455) obtained data from 481 teachers at various levels of teaching to find the effectiveness of supervision as they saw it. Eighty-six percent of the teachers regarded supervision as helpful and welcome. These teachers thought that the best supervision was scientific and democratic and 56 percent said that the supervision which they received was child-centered rather than subjectmatter centered. Furthermore, Shannon found that the range of time given by supervisors to individual teachers was from 4 to 51 hours. The teachers stated that the supervision which was helpful consisted of constructive and helpful criticism from kind and sympathetic supervisors who were well informed in their subject and interested in children. A few teachers expressed an unfavorable attitude toward supervision. They felt that too little time was given by supervisors, that the supervisors were not well informed, and that they had no constructive or helpful suggestions.

Dodd (442) reported a study of the opinions of 60 principals who kept a record over a three-year period of the chief factors which contributed to both good and poor teaching, the results of which are shown in Tables III

and IV. Allen (437) reported the supervisory practices which were most helpful to high-school teachers. One hundred and thirty-four teachers replied to a questionnaire asking them which supervisory device was most helpful. Among those mentioned most frequently were: visits and conferences, 30 percent; group meetings, 24 percent; measurement, 13 percent;

Table III.—Factors Contributing to Good Teaching, Mentioned by Sixty Principals

	No. of times mentioned
1. Daily classroom plans and preparation.....	30
2. Recognition of individual needs of child.....	30
3. Energy and enthusiasm.....	25
4. Good health.....	25
5. Sympathetic understanding of children.....	23
6. Industry.....	17
7. Knowledge of materials.....	16
8. Patience.....	15
9. Pleasing personality.....	15
10. Ability to ask challenging questions.....	15
11. Ability to create independent initiative and thinking among the students.....	14
12. Ability to hold interest of pupils.....	12
13. Ability to win and hold confidence and respect of pupils—leadership.....	12
14. Tact.....	11
15. Desire to grow professionally.....	11
16. Attractive personal appearance.....	11
17. Use of good refined common sense.....	10
18. Poise.....	10

Table IV.—Factors Conducive to Poor Teaching, Mentioned by Sixty Principals

	No. of times mentioned
1. Inadequate previous preparation.....	60
2. Lack of interest in child or job.....	37
3. Poor health.....	31
4. Teacher's lack of knowledge.....	25
5. Laziness.....	14
6. Lack of teaching technic, poor methods.....	13
7. Lack of patience.....	11
8. Weak personality.....	10
9. Lack of attention to individual child.....	9
10. Inability to ask challenging questions.....	8
11. Quarrelsome teacher.....	7
12. Lack of enthusiasm.....	6
13. Dislike for children.....	6
14. Lack of self-confidence.....	5

departmental supervision, 8 percent; demonstrations and observations, 5 percent; curriculum revision, 4 percent; and pupil adjustment and progress, 2 percent.

Supervision in Subjectmatter Areas

Many articles on supervision point out methods and devices in particular subjectmatter areas. Some of these deal with the supervision of library, reading, arithmetic, and the like. One study reported by Johnson (447) was in the field of school libraries. Two hundred and twelve high-school principals in the North Central Association area were requested to visit the library for the purpose of finding the strengths and weaknesses of teachers and the factors which contributed to those strengths and weaknesses. Eighty-seven of the principals were in schools with an enrolment larger than 1,000, and 127 principals were in schools with an enrolment between 400 and 1,000. The number of hours spent by principals in the library ranged from 1 to 30, with a median of 4 hours. From their contacts with pupils in the library, 121 principals reported that the strengths of the teachers lay in making clear and definite assignments; 54 reported that the good teachers developed assignments and stimulated pupil interest in reading and reference work, encouraged pupils to make extensive use of library materials, and suggested ways of using the library; 36 principals reported that teachers helped pupils to find library materials effectively; and 25 principals said that teachers promoted correlation of work in different fields. Among the weaknesses observed by the principal were the following: 109 said that the teacher made vague and indefinite assignments; 52 reported that the teacher did not know the library and its material and made little or no use of library material in teaching; 21 reported that teachers failed to notify the librarian of needed materials. Two principals stated that teachers did not use the library collection of professional books and two others said that too many troublesome pupils were sent to the library as a means of getting them from the classroom.

Evaluation of Supervision

Relatively few studies are reported on the evaluation of supervision. DeBoer (441) reported that an intensive supervisory program in reading in rural schools showed the following gains: (a) the attitude of the teacher was changing from a defensive one to an eager one; (b) the methods of teaching reading definitely changed in several schools; (c) there was an increase in the flexibility of the school curriculum; (d) a new interest in the teaching of reading was aroused.

Griffith (443) studied all of the white dependent schools in Okfuskee County, Oklahoma. She concluded that supervision for rural schools is of practical value and can be administered, to some extent, by a county superintendent. Neely (450) noted the difficulties of rural teachers in California

needing the most supervisory help and the technics used by representative rural school supervisors in helping teachers remedy their difficulties. The teachers in the primary rural schools needed the most help, and all the teachers who received supervisory assistance on their own problems showed improvement. She reported: "(a) Reading activity changed from teacher-dominated to cooperative pupil-teacher participation. (b) Teachers and supervisors cooperated in studying methods and children. (c) Supervision was built on strong points of teachers. . . . (d) Better methods of teaching were demonstrated. Conference and observation methods were used."

Ogle (451) made a study of 20 one-, two-, and three-teacher rural schools in Weld County, Colorado. The pupils were matched on Stanford Achievement Test Scores and Kuhlman-Anderson Intelligence Tests and by age and grade. The teachers were matched on experience, salary, age, and training. The experimental group was given some indirect supervision and the control group no supervision. In terms of final test scores, the difference in pupil achievement was small. The attendance in the experimental group, however, was better than in the control group.

Van Antwerp (458) reported a study to evaluate the effectiveness of four types of supervisory activities engaged in by the supervisory staff of Oakland County, Michigan. These four were (a) visitation by the supervisor, (b) individual conferences, (c) teachers meetings, and (d) supervisory bulletins. One hundred and fifty rural teachers expressed their opinions regarding these four supervisory activities. Sixty-two percent of the teachers preferred written criticism to oral criticism, 73 percent liked long visits rather than short ones, and 58 percent liked to be notified of visits in advance. Eighteen percent thought that strong points should be emphasized rather than weak points, while 48 percent thought emphasis on both was valuable. Ninety percent of the teachers said that a discussion of weak points was a great help and 97 percent stated that supervisory visits had changed their methods of teaching. During the time of the study the teachers made 207 visits to the supervisor's office for help, and 34 teachers asked the supervisors to come to their schools. Ninety-three percent of the teachers reported that they felt at ease with the supervisor, and 99 percent stated that they felt they could discuss frankly their problems with the supervisor. Demonstration lessons appeared to be the most helpful type of teachers meeting. However, 88 percent felt that individual conferences and meetings were equally helpful. Supervisory bulletins prepared locally were thought to be less helpful than other means of supervision; state department bulletins were thought to be of little value.

Woodring (460) called attention to the need for a more scientific approach to diagnosis of teacher needs than has been used in the past and a program for teacher betterment based on the data obtained. She suggested stenographic reports of lessons as an instrument for obtaining diagnostic information. As an illustration, she reported that of 15 pupils in one class, 6 contributed to the discussion 3 times, 5 contributed twice, and 4 only

once. The pupils used 82 percent of the hour in discussion and the teacher 18 percent. This situation, she said, "is not typical." In 99 percent of all the graphs made from stenographic reports, which she analyzed, the teacher's participation far exceeded that of the pupils. The percents on the average were: teacher, 75 percent; pupils, 25 percent. In one class in a total of 107 questions asked by the teacher, 25 were answered by the teacher and no natural questions at all were asked by the pupils.

Barr and Jayne (439) discussed methods of recording classroom observation. They advocated the use of sound recording instruments in making records of classroom instruction. These records may be used for research, self-analysis, teacher-training courses, diagnosis of pupils' speech, music and oral reading, and for standardized achievement test directions.

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